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ANNUAL REPORT OF THE
ISTHMIAN CANAL
COMMISSION

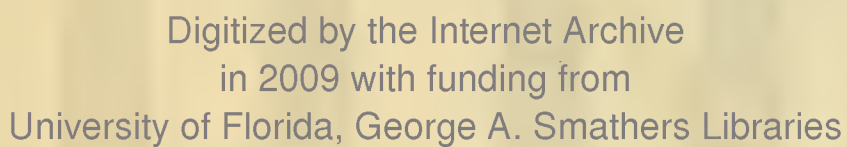
FOR THE FISCAL YEAR ENDING JUNE 30

1912

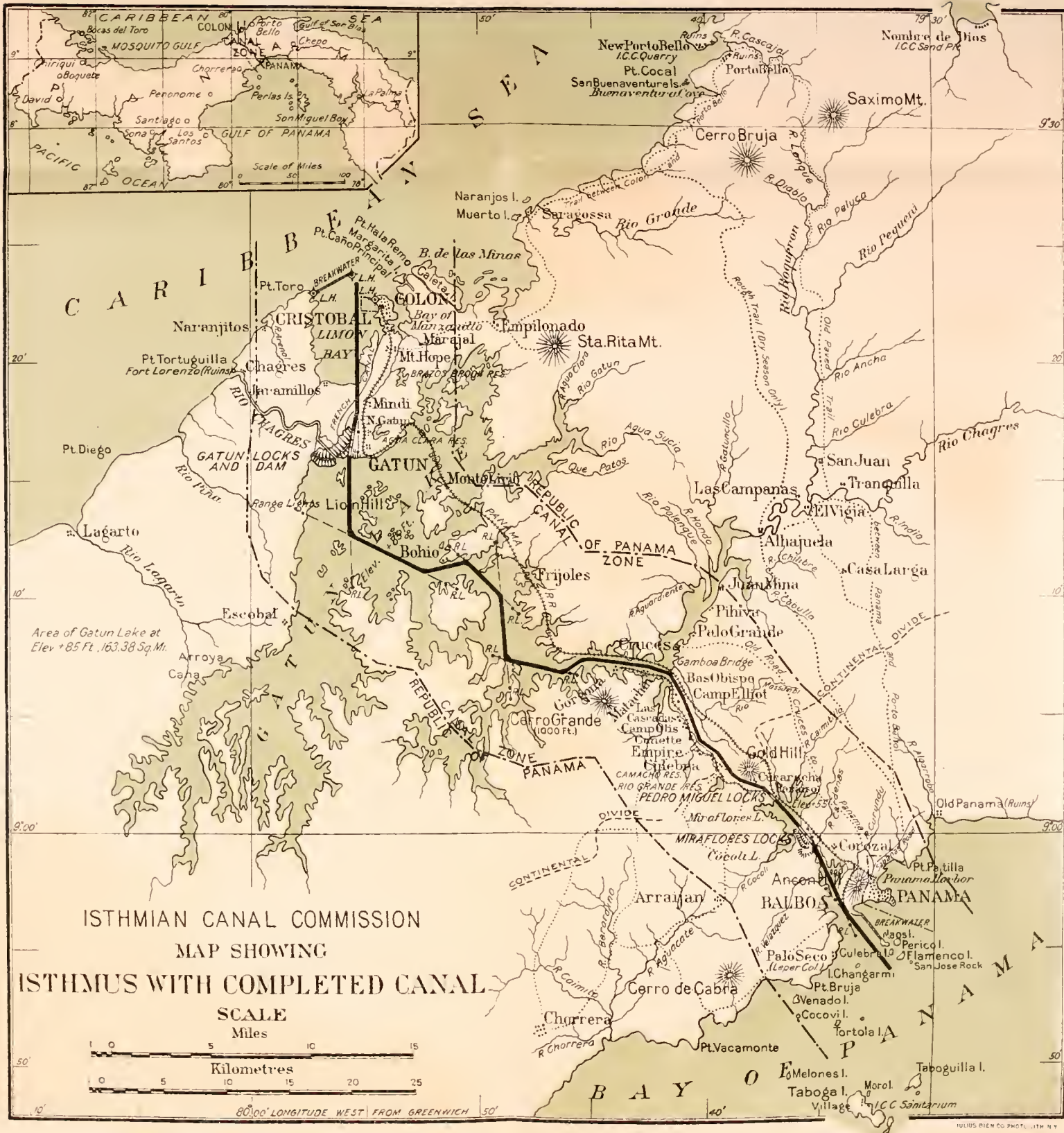


WASHINGTON

1912



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ISTHMIAN CANAL
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FOR THE FISCAL YEAR ENDING JUNE 30

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 22. Gatun lower lock, east chamber, looking north, showing temporary cofferdam at extreme end of lock chamber, June 12, 1912.
 23. Gatun Locks. General view looking southwest, showing north end of the locks, with temporary cofferdam in place, July 2, 1912.
 24. Gatun Locks and Dam, looking west from water tower, showing south center approach wall and forebay of Gatun Locks, with dam and spillway in the distance, June, 1912.
 25. Gatun Dam. West section of Dam looking west, showing progress of hydraulic fill, June 12, 1912.
 26. Gatun Spillway looking east toward locks, showing up and downstream faces of ogee dam, June 6, 1912.
 27. Gatun Spillway looking southwest, showing downstream face of ogee dam, June 6, 1912.

Following plates, 78 to 81, in portfolio.

78. General map showing location of Gatun Locks and Dam, breakwater in Colon Harbor, and channel excavation to date.
 79. Gatun Locks, progress sheet.
 80. Gatun Spillway, progress sheet.
 81. Gatun Dam, section showing progress June 30, 1912.

APPENDIX C.

[Report of the division engineer, central division.]

- PLATE 28. Culebra Cut, south end, looking south from bridge 57½ and showing the partly completed anchorage basin north of Pedro Miguel Lock. Train is on completed bottom of canal, elevation, +40. June, 1912.
 29. Culebra Cut looking north from bridge 57½, near Paraiso. The train on the left, just beyond the trestle bridge, is on the completed bottom of the canal, elevation +40. June, 1912.
 30. Culebra Cut looking north from a point south of Contractor's Hill, showing quiescent state of Cucaracha slide on right bank. The bottom of the lowest steam shovel cut, at a point opposite Contractor's Hill, is about 16 feet above the final bottom of the canal, or elevation +56. May, 1912.

- PLATE 31. Heated material west side of canal, 350 yards north of Culebra Y. Extent of heated material, 500 by 25 by 20 feet. February 16, 1912.
32. Culebra Cut looking south from Empire Suspension Bridge. The group of well drills in the middle of the canal is about 27 feet above the bottom, or at elevation +67. May, 1912.
33. Culebra Cut looking north from Empire Suspension Bridge. The nearest shovel shown, in the lowest cut, is working about 12 feet above the bottom, or at elevation +52. May, 1912.
34. Culebra Cut looking south from Cunette. The two shovels shown in the foreground are working on the bottom of the canal, elevation +40. May, 1912.
35. Culebra Cut looking north from Cunette. The two shovels shown in the foreground are working on the bottom, elevation +40. The water standing in the center drainage channel is about 6 feet below the bottom, elevation +34.
36. Culebra Cut looking north from Las Cascadas. All trains are standing on the bottom of the cut, elevation +40. May, 1912.
37. Culebra Cut looking south from bend in east bank near Gamboa. The train and shovel are standing on the bottom of the cut. The water in the drainage channel is about 10 feet below the bottom of the canal, or at elevation +30. June, 1912.
38. Channel excavated at San Pablo during dry season, 1912. This channel is completed and is 800 feet wide, with bottom elevation at +40.
39. Embankment of old Panama Railroad excavated down to +35 in April and May, 1912.
40. Slide in east bank of canal near Cucaracha, June, 1912. For plan and cross section of this slide see Plate 87.
41. Culebra Cut, Culebra. Break in east bank of canal. Amount of material involved, 320,000 cubic yards. The train shown in foreground is about 35 feet above the bottom, or at elevation +75. February 11, 1912.
42. Slide of stratified rock, west bank of canal, Culebra-on-the-dump, looking toward Culebra. Slide involves about 1,000,000 cubic yards and moved about 3 feet per day on a slope of 1 vertical to 7 horizontal. The train is standing at elevation +95. February, 1912.
43. Steam shovel 218 buried under fall of rock, west side of canal, near Las Cascadas. This shovel was working on the bottom of the canal when destroyed, May 31, 1912.
44. South end of Naos Island dump, 4,000 feet from island. Center at A is 80 feet from track and 25 feet above the original bottom. Elevation of trestle, +14. December, 1911.
45. South end of Naos Island dump, 4,000 feet from island. Center at A is 75 feet from track and 25 feet above the original bottom. Elevation of trestle, +14. December, 1911.

Following plates, 82 to 88, in portfolio.

82. Diagram of yardage and rainfall.
83. Diagram of performance of steam shovels.
84. New Culebra slide, plan and section.
85. New Culebra slide, section showing change in surface as slide develops.
86. East and West Culebra slides. Section showing amount excavated each year.
87. Cucaracha village slide, section showing change in surface.
88. Profile of Panama Canal and yardage estimate.

APPENDIX D.

[Report of the division engineer, Pacific division.]

- PLATE 46. Pedro Miguel Locks. Bird's-eye view from hill on east bank, July 28, 1912.
47. Pedro Miguel Locks. Bird's-eye view of north approach wall from hill at east end, July 28, 1912.
48. Pedro Miguel Locks, looking south. West forebay with emergency dam sill, June 5, 1912.
49. Miraflores upper locks. General view looking north from lower west bank, showing cylindrical valves, July 25, 1911.
50. Miraflores Locks, looking north, June 21, 1912.
51. Miraflores Locks, west chamber, looking south, June 23, 1912.
52. Miraflores lower locks, looking east. Electrical conduit and floor culvert at upper end of east lock January 19, 1912.
53. Miraflores lower locks. Slide back of west wall, looking south, March 21, 1912.
54. Miraflores locks. Sinking caissons for foundation of north approach wall, looking north, June 14, 1912.
55. Stripping Cocoli Hill adjacent to canal prism, March 21, 1912.
56. General view of Balboa terminal site, looking north, June, 1912.
57. Balboa lumber dock of reenforced concrete, looking northeast, June, 1912.
58. Dredge *Corozal* in channel near station 2210, June, 1912.

Following plates, 89 to 94, in portfolio.

89. Pedro Miguel Lock, concrete progress sheet.
90. Pedro Miguel Lock, forms for north approach wall.
91. Miraflores Locks, concrete handling plant.
92. Miraflores Locks, concrete handling plant.
93. Miraflores Locks, concrete progress sheet.
94. Panama improvements completed during fiscal year 1911-12.

APPENDIX E.

[Report of geologist.]

- PLATE 59. Ideal section of deforming and sliding ground near Culebra, Canal Zone.
60. Columnar structure in hardened flows of mud lava. This jointing afforded passages for seepage water which softened the basal mass, already under high pressure, and thus tended largely to promote the recent large slide just north of La Pita.
61. A, Fault plane. B, crushed and sheared zone of rock. C, stronger rocks, beds of limy sandstone. This fault is the chief cause of the big slide on the west (opposite) side of the canal near Lirio. There the overhanging rocks are not strong limy sandstone, but relatively weak clay rocks, so they easily slide out along the plane of this fault.

APPENDIX F.

[Report of the assistant to the chief engineer in charge of second division of the office of the chief engineer.]

Following plates, 95 to 109, in portfolio.

- PLATE 95. Chart showing excavation and expenditures to July 1, 1912.
96. Map of the Canal Zone and the watershed of the Rio Chagres.
97. General plan of Balboa terminals.

PLATE 98. Annual rainfall along canal location.

99. Wind roses, dry and rainy seasons, 1911.
100. Chagres River drainage basin, discharge at Alhajuela. Dry seasons 1908 and 1912.
101. Chagres River drainage basin, mass curves of discharge at Alhajuela, 1908, 1911, and 22-year period.
102. Chagres River drainage basin, mass curves of discharge at Gamboa, 1908, 1911, and 22-year period.
103. Chagres River drainage basin, mass curves of discharge at Gatun spillway, 1908, 1911, and 22-year period.
104. Chagres River, cross section at Gamboa gauging station.
105. Gatun Lake. Hydrograph from January to June, 1912.
106. Gatun Lake watershed. Rainfall, run-off, and retention curves.
107. Chagres River drainage basin, curve of discharge duration at Alhajuela, 1911.
108. Chagres River drainage basin, curve of discharge duration at Gamboa, 1911.
109. Chagres River drainage basin, curve of discharge duration at Gatun, 1911.

APPENDIX H.

[Report of the chief engineer of the Panama Railroad relocation.]

- PLATE 62. Relocation Panama Railroad. The Quebrancha bottom, looking north, June, 1912.
63. Relocation Panama Railroad. The Brazos bottom, looking north, June, 1912.
 64. Relocation Panama Railroad. Gold Hill line, looking north up the Pedro Miguel Valley, June, 1912.
 65. Relocation Panama Railroad. Gold Hill line, looking south across deep valley east of Paraiso, June, 1912.
 66. Relocation Panama Railroad. New town of Monte Lirio, looking north, June, 1912.

APPENDIX N.

[Report of the head of the department of civil administration.]

- PLATE 67. Empire-Chorrera 16-foot macadam road under construction with Zone prison labor, August 29, 1912.
68. Mandingo stockade for Zone convicts engaged in road building, August 1912.

APPENDIX Q.

[Report of superintendent of clubhouses.]

. *Plate in portfolio.*

- PLATE 110. Chart showing rise and fall of membership in Young Men's Christian Association.

APPENDIX U.

[Charts showing organization of Isthmian Canal Commission and Panama Railroad Co., July, 1912.]

All plates in portfolio.

- PLATE 111. General organization of the Isthmian Canal Commission.

Isthmian offices.

- PLATE 112.** Office force of chairman and chief engineer, assistant chief engineer, and assistant to the chief engineer.
- 113. First division of chief engineer's office.
 - 114. Central division.
 - 115. Atlantic division.
 - 116. Pacific division.
 - 117. Secretary of the commission.
 - 118. Mechanical division.
 - 119. Chief quartermaster.
 - 120. Subsistence officer.
 - 121. Civil administration.
 - 122. Chief sanitary officer.
 - 123. Disbursing officer, examiner of accounts, and department of law.
 - 124. Panama Railroad Co., including New York offices.
 - 125. Panama Railroad Co., relocated line.

Washington office.

- 126. General purchasing officer.

ANNUAL REPORT
OF THE
ISTHMIAN CANAL COMMISSION.

ISTHMIAN CANAL COMMISSION,
OFFICE OF THE CHAIRMAN,
Culebra, Canal Zone, September 10, 1912.

SIR: I have the honor to submit the annual report for the Isthmian Canal Commisison for the fiscal year ended June 30, 1912.

ORGANIZATION.

When it was determined to fortify the canal it was recommended that the construction be done by the Isthmian Canal Commission, utilizing its forces and such plant as could be spared from other work under its charge, as this would result in economy in cost and avoid the friction liable to occur if two independent organizations were carrying on work in the same locality. It was proposed at the same time, in order that the completed work might embody the latest improvements in battery construction, that the plans be prepared by the Chief of Engineers, United States Army, subject to the approval of the Panama Fortification Board, and the batteries and accessories built in accordance therewith. This recommendation received the approval of the authorities at Washington. Funds for commencing the work were provided by the sundry civil act of March 4, 1911, and work was begun August 7, 1911, under the division engineer of the Pacific division and continued in his charge until January 1, 1912, when an additional division was established in the office of the chief engineer, which took over the construction of the fortifications.

The third division of the chief engineer's office, which formerly had charge of general surveys not embraced within the limits of any construction division, together with the meteorological and hydrographic work, was abolished on January 24, 1912, when the general survey work was practically completed. What remained of this, together with the collection of meteorological and hydrographic data, was consolidated with the second division of the chief engineer's office.

The locks and their various appurtenances were designed by and under the direction of Col. Hodges, and, as noted in the last annual

report, the erection of the gates, valves, fender chains, and emergency dams, as well as the machinery for operating the lock accessories, were also placed under the division of which he has charge. Active field operations for erecting the machinery were undertaken in September, 1911, and an organization was arranged to handle the work. In the same month, under the same division, field forces were organized to undertake the erection of the range lights and other construction work required in connection with the aids to navigation.

Last year recommendations were submitted looking toward the construction of a dry dock, coaling station, and terminal facilities, and, as these seemed to be favorably considered by the congressional committees visiting the Isthmus, a designing force was organized under Mr. Rousseau for preparing the necessary plans for the dry dock, coaling stations, and machine shops.

Rather than tie up some of the French dredges on the Pacific side which could no longer work to advantage, in October, 1911, they were put at work dredging the area which was to form the basin between the canal and the proposed terminals. In June, 1912, when pending legislation indicated that the various facilities indicated would be authorized, and as time is an essential element, a force was organized under the division engineer, Pacific division, and work was begun by excavating to the north and west of Sosa Hill to enable the moving of the Panama Railroad tracks, so that work can be commenced on the machine shops and terminals. The design of the wharfs in connection with the terminals was assigned to Mr. Williamson.

Continuing the principle of concentration which was adopted in 1908, the shops which formerly had been under the division engineer of the Atlantic division at Gatun were transferred temporarily to the mechanical division on April 4, 1911, and have been so continued since that date. Effective July 1, 1912, the shops at Empire for the repair of steam shovels, and previously in charge of the central division, were transferred to the mechanical division.

With the exceptions noted, the organization of the forces on the Isthmus was continued practically as outlined in previous annual reports.

CONSTRUCTION AND ENGINEERING.

FIRST DIVISION.

The first division of the office of the chief engineer, under Col. H. F. Hodges, United States Army, assistant chief engineer, continued in charge of the design of the locks, dams, regulating works, and accessories; the design and construction of aids to navigation: the inspection of the manufacture and erection, under contract or

otherwise, of the lock gates, operating machinery, gates and valves, emergency dams and fender chains, and of the placing of such concrete in the locks as was omitted until the installation of the machinery.

During the fiscal year the general plans for the lower portion of the lower locks at Gatun and Miraflores were completed and approved, as well as the plans for the south middle approach wall at Miraflores and for the uncompleted portion of the south middle approach wall at Pedro Miguel, which was changed from the solid type already built to the reenforced cellular type for the remainder. In addition, all the drawings required for decking over various machinery chambers in the lock walls, snubbing posts, and spring buffers were prepared, so that all the detailed plans for the locks are completed and approved.

Chambers were prepared for the rising stem gate valves by lining up the fixed irons, and 12 completed at Gatun and 2 at Pedro Miguel during the year; at Gatun 12 valves were placed in position. In addition, 6 bulkhead gates were placed in the side-wall intakes and 6 in the center-wall intakes at Gatun. Three rising stem gate valves and 1 cylindrical valve were placed in the Gatun spillway. The cylindrical valves were placed in all the locks during construction and all of them are in position.

To determine the probable leakage around the rising stem valves, also the force required to start the valve and to maintain the motion, a test was made on a set of two valves which were installed in the upper valve chamber of the west side culvert at Gatun. The entrance to the culvert was closed by a water-tight bulkhead, and the culvert between the bulkhead and the valves, with the well above the valves to the top of the wall, was filled with water. By this arrangement there was a greater head against the valves than will obtain when the lock is pumped dry for examination, and considerably greater than the usual operating head. Under a 79-foot head that resulted the combined leakage of both valves was 1.82 cubic feet per second, while the combined friction resulting from the contact of the side seals of the gate, as well as the action of the roller trains, averaged 21,170 pounds for each valve. It had been assumed at 31,750 pounds in the design of the machinery which was intended to exert a lifting force of 60,000 pounds, including all friction and the weight of the valve and its accessories. It is probable that both the friction and the leakage will be reduced in subsequent valves, as certain improvements in detail and workmanship are found in those of later construction.

One of the cylindrical valves in the locks at Gatun was tested for leakage from the exterior by constructing a bulkhead across the

entrance to the valve chamber, which was then filled with water. When the head reached 60 feet the leakage was found to vary from a quantity too small to measure to about 0.25 of a cubic foot per second. The average was about what was to be expected from the tests made at Pedro Miguel and described in the last annual report. Examination indicated that the leather seal or gasket was sufficiently rigid to hold up the movable portion of the valve and prevent its seating properly. The segments which clamped the leather seal were removed and the edge beveled slightly to allow an easier bending of the gasket. After this was done the leakage was found by measurement to be about 0.015 of a cubic foot per second, or about one-tenth of that previously measured. The segments for all the valves are being beveled in the manner indicated as advisable by this experiment.

The two rising-stem valve machines furnished under contract were tested at the works of the manufacturer and found to be satisfactory, after which the commission exercised its option and contract was entered into December 5, 1911, for furnishing all parts for 114 rising-stem gate-valve machines without motors. After successful test of the first two cylindrical valve machines at the works of the manufacturer, contract was awarded, on October 25, 1911, for 118 additional cylindrical valve machines without motors and 12 auxiliary culvert valve machines without motors. Up to June 30, 1912, a total of 21 rising-stem valve machines (except valve stems and thrust screws), 34 cylindrical valve machines, and 3 auxiliary culvert valve machines were received. Delays in shipment occurred, caused by the strike of stevedores at Baltimore, the point of shipment.

Owing to the peculiar climatic conditions on the Isthmus, involving tropical heat and extreme humidity, and the deteriorating effect of these conditions on the insulation of electrical machinery, it was necessary to investigate thoroughly the different kinds of insulation available for use on the lock machinery. To accomplish this, 16 sample motors in all were purchased, 2 from each company offering bids for the motors required. Eight of these were sent to the machine contractors for operating tests on the valve machines, and the other 8 were shipped direct to the Isthmus, where they were subjected to the extreme conditions specified in the specifications accompanying the invitation for bids, in order to test the insulation. They were first placed in a storehouse at Gatun and exposed to the ordinary conditions of climate for a period of about two months, during which time the condition of the insulation was determined periodically by inspection and tests. In order to expedite the action of the heat and humidity they were subjected to a steam test, in which the extremes of temperature and humidity mentioned might be reproduced. In order that the conditions of all motors might be

identical in all respects, the motors were placed in a small building erected for the purpose and the tests performed on all motors simultaneously, so that the motors were subjected to the same humidity and temperature for the same length of time. Briefly, the tests consisted of filling the building in which the motors were located with steam, thereby maintaining a temperature of 50° C. for a period of 10 days, making potential tests and measurements of insulation throughout this period. In addition to the steam test, the motors which survived were immersed by filling the case with water at a temperature of approximately 30° C. and maintaining this condition for about five hours, during which time observations of insulation resistance were made continuously. The eight motors which were first shipped to the machine contractors were, after reaching the Isthmus, subjected to the immersion test but not the steam test. The tests were conducted without the presence of any representative of the manufacturers.

The relative standing of the various types of insulation in these tests was, in general, definite and the choice of the most suitable insulation was clear; however, in view of the number of motors tested, it was desirable to obtain a numerical basis of comparison. A schedule of the various stages of the tests was therefore prepared and a number of points assigned for the survival of each of these stages. The motors were given four points for surviving the test; three if, after failure during the test, the insulation recovered without repair; two if, after such failure, the insulation was found possible of repair; one if, after repair, the motor recovered; and none if they failed to recover at all. The total points for each of the four motors representing the manufacturer in the entire series of tests then served as an index from which the relative value of the insulation could be determined. The contract was awarded on the basis of the tests as above outlined. None of the motors had been shipped on June 30.

A series of tests was also made on the sample limit switches purchased under similar conditions as the motors. Insulation and potential tests were made under the climatic conditions of the Isthmus and, while they were not so extensive as the motor tests, sufficient information was obtained to determine the suitability of the various makes and the award on this class of apparatus. Satisfactory progress has been made in the manufacture of these switches, and at the end of the year 50 were reported as shipped from the works of the contractor.

The lock gates are being constructed and erected under contract dated June 21, 1910. During the past fiscal year the shop drawings for all the different heights of gates were completed and approved. The total steel plates and shapes accepted at the mills to the end of

the fiscal year aggregated about 52,322 tons, which practically comprised all the rolled material required, excepting that for the spare parts. About three-quarters of all the castings were made, machined, and accepted. All specified chemical and physical tests were carried out and the contract requirements as to the quality of material were in all cases fully met. The only change in the material for any part of the gates was made in the bushings for the pintles at the bottom of certain leaves that will always be in sea water. In order to avoid possible damage through electrolytic action, these bushings will be made of hard-cast Vanadium steel instead of the manganese bronze used in the other gates. Certain of the other leaves which will be operated in brackish water are to be protected from erosion by the use of zinc rings placed close to the bronze bushings.

The total shipment of structural material to the end of the fiscal year 1912 aggregated about 39,000 tons, or 76 per cent of the amount required for all the gates. Of the above total, about 32,000 tons were shipped during the fiscal year, so that on June 30, 1912, a total of 13,000 tons remained to be forwarded, comprising about half the material for the gates in the intermediate locks at Gatun and the upper locks at Miraflores and all the material for the gates in the lower lock at Miraflores. At this rate of progress the steel work for all the lock gates and the spare parts provided for in the contract will be completed in the shops before November 1, 1912.

On June 30, 1912, the work of erecting the gates on the Isthmus was in progress on 23 gates, or exactly half of the total number on the canal, but these gates were in various stages, and none of them was entirely completed. They comprised all the gates in the upper lock and the intermediate gates in the lower lock at Gatun and all the gates at Pedro Miguel excepting the lower guard gate in the west chamber. No material was placed at Miraflores. The total steel in place in the several gates at the end of the fiscal year amounted to 19,631 tons, or about 34 per cent. With the exception of 412 tons previously reported, all of this material was erected during the fiscal year. The total number of field rivets driven to June 30, 1912—practically all of them during the fiscal year—was 963,500 out of 5,750,000, or only 17 per cent of the total.

The completion of the several gates has fallen considerably behind the dates specified in the contract, due in part to the failure of the contractors to deliver the necessary material and tools on time, and in part to the limited number—and in some cases to the poor quality—of mechanics and laborers. This has been the case especially in the field riveting and the machine work necessary for the erection of the gates. A close and continuous inspection was maintained, and it is believed that the completed gates will meet fully the standard laid

down in the specifications. The tests for watertightness made in the first gate at Gatun indicate excellent workmanship in this respect.

Contracts were entered into toward the end of the previous fiscal year for the first two miter gate-moving machines and for the first miter forcing machine. These were completed and satisfactorily tested at the works of the contractors and shipped to the Isthmus. The miter gate-moving machines were installed in their respective places, and one tested in regular service of swinging a gate in the dry. The operation was successfully performed in 1 minute and 48 seconds, or 12 seconds less than the estimated time. As the tests were satisfactory, the contract for the remaining 90 miter gate-moving machines was made on February 11, 1912. The award for the motors for these additional machines was also made. The installation of the miter forcing machine was not completed at the close of the fiscal year, as the structural features of the gate were not ready to permit of its installation.

The design selected for the construction of the chain fenders was described in the last annual report, and during the fiscal year bids were invited and contracts entered into for the delivery on the Isthmus of all parts of one fender except the chain, which was built at the United States Navy Yard at Boston. Under these contracts the commission reserves the right to purchase the material for the other 23 fenders at prices named in the contractors' bids, if the test of the one proves it to be satisfactory. To determine the best form of emergency resistance valve, an elaborate series of tests was made in the power plant of the Prudential Insurance Co. at Newark, N. J. Three types of valves were tested under conditions approximating those of actual operation, two of them giving satisfactory results. The chain is the only part of the apparatus that was shipped to the Isthmus.

All material for the structural steel covers by which the electric locomotive track is supported over the lock-gate recesses in the masonry has been provided for and the erection of the steel in the field was let by contract dated July 7, 1911. At the close of the fiscal year the erection of all the covers in the Gatun and Pedro Miguel Locks had been practically completed, but no work had been done at Miraflores.

The electric-towing locomotives were described in the annual report of 1910. Bids for these machines were invited, and the same policy was followed as in the case of other machines of asking the price for one and also on the remainder if the sample proves satisfactory. A contract was entered into for the delivery of one locomotive complete, with the option of purchasing the other 39 that will be required. Under the contracts for materials in connection with

the locomotive track, 95 per cent of the structural parts was completed during the year. The delivery of the steel rack sections was 44 per cent completed; considerable difficulty was experienced at first in producing sections which were sufficiently accurate for the purpose intended, but this was subsequently overcome. There was delivered on the Isthmus 60 per cent of the malleable-iron supporting brackets for the conductor-slot covers, but these were rejected on account of general irregularities. The contract for furnishing malleable-iron cover plates and washers was completed. The bids first received for crossovers and turnouts were not satisfactory and were rejected. A readvertisement secured lower prices and a contract was entered into for furnishing them. Up to the end of the fiscal year none had been shipped.

Specifications were issued September 9, 1911, covering the main generating equipment for a hydroelectric station, containing three 2,000 kilowatt units, to be located adjacent to the spillway in Gatun Dam. The equipment is to consist of three 2,250-kilowatt water turbines, three head gates, three penstocks, three governors, three draft tubes, three 2,000-kilowatt generators, three direct-connected 50-kilowatt exciters, two 100-kilowatt motor-driven exciter sets, one 30-ton electric crane, and one lubricating system. A contract was entered into December 2 for the hydraulic equipment, with promise of delivery in 150 to 195 days for the water wheels and governors, 125 to 150 days for the penstocks, and 90 to 120 days for the head gates. A contract was entered into on the same date for the electrical equipment, with promise of delivery in 170 to 200 days for the generators and 140 to 160 days for the exciters. At the close of the year one generator was completed and ready for test at the works of the contractor. The only material delivered on the Isthmus is 60 per cent of the penstocks. Every effort is being made to have the remainder of this material on the Isthmus at an early date, and the latest advices from the United States indicate that complete shipment has been made.

There will be available sufficient water from the storage in Lake Gatun to warrant the installation of 6,000 kilowatts in generating capacity, including reserve. The average head throughout the year will be approximately 75 feet, the elevation of the tail race being about 8 feet above sea level. During the dry season it will be necessary to draw upon the storage in Gatun Lake. The maximum quantity of water diverted for hydroelectric development is approximately 7 per cent of the minimum water supply and is the excess which is not required for lockages, evaporation, and leakage.

The spillway-gate machine is designed to raise or lower, in approximately 10 minutes, a spillway Stoney crest gate for controlling the water levels of Gatun and Miraflores Lakes. It consists essen-

tially of two counterweights, one at each end of the gate, connected to it by a screw and chain, the screw being moved vertically by means of a worm nut which is motor driven by a worm. The two screws at the gate ends are driven simultaneously through a driving shaft which is provided with a worm at each end for operating the worm nuts. The screws are held in a vertical position, and the hoisting chains pass over sheaves at the tops of the gate piers. The counterweights practically balance the weight of the gate, so that the machine has to overcome only the resistance to the movement of the gate due to water pressure. The machinery tunnel extends the full length of the spillway, within the dam, and contains all the operating machinery. The screws for lifting the gates pass through this tunnel, extending downward to the counterweights and upward to the hoisting chain through openings provided for the purpose. Bids were invited for 22 spillway-gate machines and a contract awarded.

On January 31 specifications were issued for the purchase of apparatus for the remote control and indication of the lock machinery and spillway gates. The system includes starting panels for the various sizes of motors and switches; also remote indicators for showing at the control switchboard the position of the various machines. Bids were opened on March 15 and contracts awarded.

For supplying electric current to operate the lock machinery 16 transformer rooms are provided in the locks at Gatun, 8 at Pedro Miguel, and 12 at Miraflores. Each transformer room is practically an independent substation, interconnected with the others in the same locks by means of primary feeders. Power is taken at 2,200 volts from the hydroelectric station and is transformed to 220 volts. Each room is to contain two 190 kilowatt power transformers, either one of which can carry the motor load of the section fed from one transformer room. All equipment, including primary feeders, will be in duplicate, to insure continuity of service. The transformer room will also contain a 25-kilowatt lighting transformer, a bank of 9 or 10 oil switches, a 7-panel, low-tension switchboard, and miscellaneous cable and terminal equipment. In designing the transformer rooms every effort was made to render all operations simple and foolproof, and care was used to avoid the possibility of shut-downs and operating troubles.

The general features of lock illumination, both exterior and interior, were fixed during the year. For exterior lighting concrete lamp standards will be erected on the coping of the locks approximately 100 feet apart throughout the entire length of each wall. In all there will be 211 lamp standards at Gatun, 131 at Pedro Miguel, and 169 at Miraflores, a total of 511. The standard is of special design and supports a reflector about 30 feet above the coping level.

The reflector is intended to throw the light of a 400-watt Tungsten lamp outward over a ship in the lock chamber and also to produce a uniform illumination over the surface of the wall, without the glare occasioned by the brilliancy of the lamp shining directly into the eyes of an approaching pilot. For interior lighting of operating tunnels and machinery rooms, deck lights have been arranged in the roof of the operating tunnels which will admit sufficient light in the daytime to permit of circulation. For use at night, or when repairing machinery, artificial illumination is provided by the ordinary 16-candlepower carbon filament lamps mounted in specially designed reflectors set in the concrete of the ceiling and walls. A total of about 7,000 lamps will be installed in all the locks.

The work of erecting the lock machinery was begun at Gatun in September, 1911, and at Pedro Miguel in January, 1912. Owing to delays in the receipt of machinery, the schedule of erection has not been adhered to in all cases, but the installation and erection are progressing as fast as deliveries permit. Nine thousand four hundred and fourteen feet of towing track, including the conductor slot channels, have been assembled, lined up, and tested, and a total of 2,348.9 cubic yards of concrete was laid in connection with the towing track and miter gate recess covers at a cost of \$16.0344 per cubic yard.

Under the contract entered into on May 16, 1911, for the construction of the emergency dams, 2,786 tons of material were shipped from the various plants of the contractor in the United States, and it is expected that all of the material for the first two dams will be shipped before August 1. Shipments to the Isthmus were somewhat delayed, thereby interfering with the erection work, due to a stevedores' strike, so that of the amount shipped only about 1,700 tons were received on the Isthmus. The false work and the erection cranes for the east dam at Gatun were completed, which will enable the contractor to begin work immediately upon receipt of those pieces which are first required for erection. No work of any kind has been done at any of the other dam sites.

Contracts were made for the emergency dams and gate and girder hoisting machines, also for the electrical equipment for operating the machines. Satisfactory progress was made during the year; the first machine of each type was tested and the other machines advanced so that they will soon be ready for test. Tests of the worm gearing were carried out, so that the motor characteristics and the hand-operating mechanism could be adapted to the results of the tests.

Work on the detailed drawings for the floating caisson gates was continued during the year on the basis of the general design described in the last annual report. The plans for various decks have been drawn out and a detailed study made of the pumps and piping.

Contracts aggregating \$3,683,306.29 were entered into during the year on specifications prepared by this division for various irons in connection with the locks, for electric locomotives, tracks, machines, pumps, electrical equipment; in short, for all necessary appliances for completely equipping the locks for satisfactory operation, except the machinery for the guard valves, which will be advertised in the near future, and the material for the transmission line which will connect the hydroelectric station at Gatun with the locks of the Pacific division.

To enable a pilot to keep his course up to the turning point it is necessary to have a range of two lights at each end of the longer tangents in prolongation of the sailing line. The prolongations of these tangents on which the lights are situated were covered by heavy growths of brush and timber, so that trocas had to be cut through the jungle until suitable locations were found. These trocas are the width of the canal at the beginning and narrow down to 480 feet at the end. During the year a total of 809.85 acres was cleared, at a cost of \$22.7098 per acre, and 305,790 linear feet of trocas cut.

Field forces were organized and construction work begun on the range towers at the Pacific entrance September 1, 1911. The towers, which are of concrete, are being constructed by means of steel forms, which are designed for the three types of towers used in the Atlantic and Pacific sections. The forms are 4 feet in height and of such size as to be easily handled by two laborers. They are made in segmental sections or staves, and when the form is shifted to a higher position the desired taper is given by omitting a section entirely or substituting a narrower one. One set of forms answers for all towers of the type used in the sea-level sections and another set for all towers of Gatun Lake. The forms for the watch room and lantern room are set up and filled when the body of the tower has been finished. Eleven of the towers required by the system have been completed to date—Nos. 5 and 6, Atlantic section; Nos. 2, 9, 11, 13, and 14, Pacific section; Nos. 1, 21, 24, and 25, Gatun Lake section. In the construction of these towers 805.88 cubic yards of concrete were used, the larger portion reenforced. The position of 60 gas buoys was located, referenced and checked, and three beacons in the Gatun Lake section located. The illuminants will be gas and electricity, the latter wherever the light is sufficiently accessible. For the floating buoys and for the 23 towers and beacons, which are in inaccessible places, compressed acetylene, dissolved in acetone, has been adopted. White lights will be used throughout, and, in order to eliminate the possibility of conflicting the lights with one another and with the lights on shore, all range lights, beacons, and buoys will have individual characteristics formed by flashes and combinations of flashes of light and dark intervals. The candlepower of the range lights

will vary, according to the length of the range, from about 2,500 to 15,000 candlepower. The most powerful ones will be those marking the sea channels at the Atlantic and Pacific entrances, which will be visible for from about 12.5 to 18 nautical miles. The beacons and buoy lights will have about 950 candlepower.

For further details concerning the work of this division, attention is invited to Appendix A.

ATLANTIC DIVISION.

The work of this division embraces the construction of the locks and dam at Gatun, the quarry at Porto Bello, the sand supply from Nombre de Dios and elsewhere, the excavation between the locks and deep water in the Caribbean, the breakwater for the shelter of shipping and protection of the channel in Limon Bay, the municipal improvements in Colon and the various settlements embraced within the territorial limits of the division, and such sanitary engineering work within the same limits as is prescribed by the sanitary department. The work is in charge of Lieut. Col. William L. Sibert, United States Army, as division engineer.

At the close of the previous fiscal year the excavation necessary for the construction of so much of the Gatun Locks as lie above the lower caisson sills was completed, with the exception of the excavation for the lateral culverts in the lowest lock. This was completed during the fiscal year just ended by the removal of 8,888 cubic yards, at a cost of \$2.9598 per cubic yard. The material to be excavated in order to permit the construction of the portions of the locks including the wing walls and approach pier at the north end consists, for the most part, of mud too soft to support steam shovels, as the water can not be entirely excluded, so that recourse must be had to dredging. A suction dredge operated in the area between December, 1908, and June, 1909, and again between January 1, 1911, and April 14, 1911. Nothing further was done until February 1, 1912, or until after the completion of the temporary dam which was mentioned in the last annual report and which was designed to prevent the water from flooding the locks during excavation. This dam, which was completed on January 15, 1912, is 46 feet 4 inches high by 200 feet long, and consists of a series of reenforced concrete buttresses supporting timbers. The amount of material used was 1,040 cubic yards of concrete and 98,736 feet b. m. of lumber. The cost of its construction was \$36,092.91. The total amount removed by the dredges was 883,918 cubic yards, at a cost of \$0.3129 per cubic yard, which includes a plant charge of \$0.0410 for the cost of the temporary dam. It is estimated that 89,570 cubic yards will complete the excavation necessary to permit unwatering of the area, so that the construction of the wing walls and north center approach pier can

be begun. In order to secure suitable foundation, it was necessary to excavate in places to a depth of 70 feet below sea level, which required closing the opening through which the dredges were admitted by an earth dam and lowering the water so that the dredges could work to this depth. The material removed by the dredges was pumped behind the levee constructed east of the Panama Railroad; a large portion escaped, filling the Mindi River and the French Canal where these two cross, but it is stated that none reached the new channel. After March 31, 1912, the material was pumped to the west of the canal prism.

As noted in the last annual report, the unloading plant in connection with the sand and stone deliveries consisted of the cableways and five derricks. From July 1, 1911, the cableways operated on a single shift of 9 hours until June 1, 1912; subsequent to this date occasional 12-hour shifts were worked to facilitate the delivery of sand from a new source of supply in the Chagres River. During the year the cableways unloaded 237,750 cubic yards of rock and 109,017 cubic yards of sand; they average 30.42 cubic yards per hour while in service, or 52.74 cubic yards per hour actual working time; in other words, 57.69 per cent of the time was consumed in unloading operations, the balance lost in waiting for barges, 26.35 per cent, and in other delays, 15.96 per cent. The five derricks were in use for unloading rock and sand until November 16, 1911, when the two sand derricks were put out of commission; the remaining three engaged in unloading rock ceased operations on April 29, 1912. During the time they were in service the derricks unloaded 139,148 cubic yards of rock and 53,768 cubic yards of sand—a total of 192,916 cubic yards of material. This material was unloaded by the derricks at an average rate of 25.57 cubic yards per hour while in service and 49.87 cubic yards per hour in actual working time of unloading. The operating cost of handling material by cableways and derricks, exclusive of plant charges, was \$0.1904 and \$0.1574 per cubic yard, respectively. In addition to unloading, the cableways also transferred rock and sand from the stock piles to the tunnel hoppers, which added for the last quarter of the year \$0.2646 per cubic yard of concrete laid.

When the deliveries of crushed stone from Porto Bello were stopped, the rock screen, which had been supplied by a derrick unloading directly from barges, was dismantled, placed on a car, and moved to one side of the rock-storage pile where the cableways have access to it, and since May 23, 1912, one duplex cableway has been employed exclusively with the rock screen. From July 1, 1911, until April 30, 1912, when the delivery of cement in barges was discontinued, the cement shed cranes unloaded 448,700 barrels of cement. On the latter date arrangements were made for delivering the remainder of the cement in cars, which will be unloaded by hand. The amount re-

quired at the end of the fiscal year for completing the work, in addition to that already in storage, was 190,000 barrels.

During the year an average of 4.30 of the eight 2-yard mixers installed in the construction plant furnished a total of 343,364 cubic yards of concrete (bucket measurement) and were operated daily, except Sundays, on the basis of 12 hours per day from July 1 to January 31, 1912, and 9 hours per day from February 1 to June 30, 1912, at the rate of 25.52 cubic yards per mixer per hour in service, or 59.25 cubic yards per hour at work. The auxiliary plant mixers, two in number, operated on an average of 9 hours a day until March 11, 1912, when the plant was shut down and dismantled; this plant mixed a total of 80,544 cubic yards of concrete (bucket measurement) during the year, an average of 22.20 cubic yards per mixer per hour in service, or 68.54 cubic yards per hour at work. An average of three $\frac{1}{2}$ -yard mixers, together with a small portion mixed by hand, produced a total of 15,758 cubic yards of concrete. The product of the construction-plant mixers was placed by cableways, or transferred by chutes to narrow-gauge equipment, from which the concrete was dumped in place. The cableways were operated 12 hours a day up to January 31, 1912, subsequent to which a 9-hour day was used. Of the time in service, 38.74 per cent was consumed in handling 309,534 cubic yards of concrete and large rock, 17.77 per cent in handling forms and irons, etc., and 43.49 per cent in delays. Each cableway handled an average of 31.46 cubic yards of rock and concrete per hour when engaged on that work. The narrow-gauge equipment handled, in addition to large stone, 100,990 cubic yards of concrete from mixers and 24,434 cubic yards previously handled by cableways.

Work on the upper or south approach pier was continued throughout the year on the fill reported in the last annual report. For the foundation of the wall a total of 73,695 linear feet of concrete piling was manufactured during the year, at a cost of \$1.2156 per linear foot, and 75,474 feet were driven. As previously reported, difficulty was experienced with the longer concrete piles, and, because of this and also to expedite the work, 51,450 feet of creosoted piles were substituted. Reenforced concrete construction was used for the south approach pier and 31,000 cubic yards of concrete laid in it during the year, completing about 67 per cent of it. The guide walls at the south end of the locks were completed and 6,000 cubic yards were placed for this purpose.

The total amount of masonry—concrete and large stone—laid by the concrete plant, auxiliary plant, portable mixers, and by hand aggregated for the year 451,025 cubic yards; of this amount, 59,883 cubic yards were reenforced. Of this total, 371,388 cubic yards were laid during the time the 12-hour day was used, so that only 79,637 cubic

yards were laid since January 31, 1912. The division cost of the masonry was \$7.7552 per cubic yard. The large stone laid in the concrete, aggregating 14,194 cubic yards, cost \$1.3283 per cubic yard delivered in the concrete, resulting in a saving of \$49,300. The total amount of concrete laid in the locks to the close of the fiscal year was 1,875,965 cubic yards, at an average cost of \$7.1142 per cubic yard. On the basis of 2,000,000 cubic yards, the masonry work of the Gatun locks was 93.80 per cent completed.

The slides at the north end of the locks continued to give trouble during the year, interfering with the extension of the cableway tracks.

The back filling in rear of the side walls of all the locks was continued during the year. The back fill in the center wall of the upper and middle locks was completed. Material was secured from borrow pits and the excavation at Mindi, and a total of 922,215 cubic yards were placed behind the side walls, at a cost of \$0.4615 per cubic yard. The amount of back fill placed during the year, added to that reported in the last annual report, makes a total of 1,462,074 cubic yards in place. The total fill in the center wall aggregates 97,291 cubic yards, at an average cost of \$0.7692 per cubic yard.

Crushed stone for the concrete of the locks and spillway was obtained from the Porto Bello quarry until April 30, 1912, when the crusher plant was shut down, as it was estimated that there was a sufficient quantity in storage at Gatun to complete the concrete work. Though the eight-hour day was in force, the crushing plant was not operated at full capacity, as the output was limited to three barges per day subsequent to June 19, 1911. The total amount produced up to the time that the quarry was shut down aggregated 440,413 cubic yards, at an average cost of \$1.4280 per cubic yard. The output of the crushers averaged 217.60 cubic yards per hour in service and 436.56 cubic yards per hour crushing. The material was transported to Gatun in barges, thence transferred to the stock piles. The cost delivered in the stock piles at Gatun averaged \$2.4952 per cubic yard.

The Porto Bello quarry is also supplying rock for the outer stone armor of the breakwater at Toro Point. During the first month and a half of the fiscal year just ended work was continued on the dock for handling this stone and on the construction of tracks in the breakwater quarry. On August 18 production was begun and on November 20 one of the cranes ordered for the quarry was put into service. Work with this crane developed the fact that the stone could be loaded much more rapidly and economically by steam shovels, and the use of cranes for this purpose was accordingly abandoned. To enable the continuance in service of the locomotives and some of the cars employed in the quarry for the production of

crushed stone, 42-inch gauge tracks in the breakwater quarry were originally contemplated, but 18 additional flat cars which had been ordered as part of the equipment were lost in transit and the order was not duplicated, as experience indicated that the standard 5-foot gauge tracks would be more satisfactory. It was not practicable to release any of the standard equipment from work elsewhere on the canal, and the quarry was operated at a low rate of output with the incomplete narrow-gauge equipment and consequently at an increase in cost. The stone-bin dock was reenforced and changed to adapt it to the use of cranes for handling breakwater stone; it was practically completed on June 30. The breakwater quarry is on a site lower than the quarry for the crushed stone and is being developed in two benches. Each will have a breast of 60 feet at the highest point. Eleven hundred linear feet of the lower bench have been developed, and the length of the upper one will be practically 1,700 feet. The total amount quarried aggregated 65,133 cubic yards, at a cost of \$2.7092 per cubic yard on board barges at Porto Bello.

Sand was obtained from Nombre de Dios by use of dredge *No. 4* until November 17, 1911, when the sand storage pile at Gatun was filled, the work was closed down, and the plant removed. The operations of other departments at this locality also ceased. The total amount secured from July 1, 1911, to this date, 144,123 cubic yards, was transported in barges to Gatun. The cost per cubic yard in the stock pile was \$2.2414. Chamé sand was procured from the Pacific division during January, February, and March, when the Pacific division's equipment was not sufficient to permit further shipments; a total of 20,315 cubic yards was placed in the stock pile from this source, at a cost of \$1.7079 per cubic yard, including an arbitrary of \$0.7890 for the unabsorbed plant at Nombre de Dios. On May 3, 1912, the division engineer was authorized to reopen sand operations at Nombre de Dios for obtaining by use of a suction dredge the balance of the sand needed for the locks and spillway; before this was done, however, it was decided to use the sand secured by one of the dredges from the old bed of the Chagres River, and since May 15, 40,531 cubic yards were obtained from this source; of this amount 1,771 cubic yards were placed in cars and the balance in barges, which were unloaded by cableways. The cost of this sand delivered in the stock pile was \$1.2850 per cubic yard, including a Nombre de Dios plant charge of \$0.7671. For the transportation of sand, stone, and cement an average of 3 tugs, including 1 stern-wheel towboat, 6 lighters, and 16 barges were in use. Under date of February 2, 1912, 1 tugboat and 3 barges were sent around to the Pacific side of the canal, with the intention of increasing the equipment at this locality so as to furnish the balance of the sand required by the Atlantic division. The tug and barges left Cristobal February 11, 1912, and

arrived at Balboa June 17, 1912. The source of sand supply from the old Chagres River bed renders unnecessary the further procurement of sand from the Pacific division.

At the close of the previous fiscal year the dry fills for the east portion of the Gatun Dam, extending from the locks to the spillway, had been raised to an elevation of 85 feet and the hydraulic fill to 73 feet above mean sea level, while the north and south dry fills of the portion west of the spillway were at an elevation of 60 feet and 67 feet above sea level, respectively, and the hydraulic fill between the dry fills at 57.3 feet above sea level. At the close of the fiscal year just ended sufficient material had been added to raise the dam for a length of 1,000 feet east of the spillway to an elevation of 103.35 feet; for the balance of the portion east of the spillway the dry fills had reached a general elevation of 96 feet and the hydraulic fill between them a general elevation of 85 feet; for the portion of the dam west of the spillway, the north and south fills had reached a general elevation of 98 feet and the hydraulic fill an elevation varying from 87 feet at the spillway to 78 feet at the drains located in the northwest corner. In securing the increases in elevation noted the cross sections taken in June, 1912, show that the dry fill was increased by 2,544,526 cubic yards and the hydraulic fill by 2,543,086 cubic yards. In obtaining this amount of 5,087,612 cubic yards of net fill, 9,048,896 cubic yards of material (borrow pit measurement) were handled; in other words, there was a loss of 43.8 per cent. The dry fill in place in the dam shows a loss of 15.53 per cent resulting from consolidation in the mass of the dry fill and from its intermixture with the hydraulic material. The wet fill, measured in place, shows that a loss of 56 per cent resulted, due mainly to waste of soft material in suspension through the drain pipes, leakage from the pipes, and general consolidation. The cost per cubic yard of dry fill averaged \$0.5174 and for wet fill \$0.3844 per cubic yard, on the basis of material handled; on the basis of actual increase in the dam, these costs were \$0.5303 and \$0.3938, respectively. For use in the dry-fill portions of the dam, 1,465,596 cubic yards of spoil were obtained from the central division between July 1, 1911, and February 15, 1912, at a cost of \$0.1040 per cubic yard delivered on the dam. On the latter date the old double-track line of the Panama Railroad south of Gatun was abandoned, necessitating a reduction in the number of trains per day that could be sent from Culebra Cut, if this source of supply were continued, as they were obliged to operate over the single track of the relocation. To supply the additional amount that could be used economically, borrow pits must be opened, and, on the estimate that all the dry fill could be secured subsequent to this date more cheaply from borrow pits in the hills west of the dam, the delivery of spoil from Culebra Cut was stopped and the borrow pits

as a source of supply were adopted. From two to six steam shovels operating in these pits and in the vicinity of the spillway removed 1,467,675 cubic yards at a cost of \$0.3027 per cubic yard delivered on the dam. In addition to the foregoing sources of supply, 15,962 cubic yards were obtained from the excavation through the Mindi Hills, 62,689 cubic yards from power house excavation, and 448 cubic yards from lock excavation.

The hydraulic fill was pumped into the dam by five pipe-line dredges working in borrow pits upward of one and a half miles distant, the maximum lift of the material being 100 feet. Two of them worked south of the dam and three north of that structure; of the latter, one worked only about three months of the year in this locality. For the longer pipe lines and higher lifts, one or two relay pumps were installed to assist the dredges. One of the dredges on the south side worked between February 1 and July 6 in pumping material along the south toe of the extreme western portion of the dam, spreading the foundation of the structure in order to overcome the slipping that was taking place in the blanket over the face of the hill on the west on which the dam rests. It handled 582,410 cubic yards in this work. The other dredge on the south side handled 594,495 cubic yards of material in spreading the fill which had been made to support the south approach pier of the locks, and which began to settle under the weight of the pier. Of this total amount, 36,000 cubic yards were handled in September, 1911, the balance between January 1 and May 31, 1912.

The original plan of the dam, given in the report of the Board of Consulting Engineers for the Panama Canal, dated February 5, 1906, contemplated a width of 100 feet at a height of 135 feet above sea level, with side slopes on the upstream side of 1 on 3 to elevation 90 and then 1 on 2 to elevation 135. On the downstream face the slopes, starting at the top, were to be 1 on 2 down to elevation 88, then 1 on 25 to elevation 20, 1 on 50 for the next 10 feet in elevation, terminating with a slope of 1 on 2 to sea level.

During 1908 difficulty was experienced with one of the Panama Railroad embankments on the relocation south of Gatun, which necessitated spreading the lower courses of the fill. In this case the slope of the line joining the top of the completed embankment with the bottom edge of the bench which was constructed to spread the foundation over the relatively soft area was between 1 on 7 and 1 on 8. Assuming this for the slope of the dam, the division engineer prepared a plan of cross section in January, 1909, in which the upstream slope from elevation 60 was fixed at 1 on 7.67 to elevation 105, where the width was 100 feet, and the downstream slope was 1 on 11.63, continuing to elevation 30.

In 1909, when the board of engineers appointed by the President visited the Isthmus with the President elect, for the purpose of reviewing the project to determine whether any change should be made as the result of the slip which had occurred in the rock fill on the south toe of the dam, the proposition of reducing the height of the dam and flattening the slopes was submitted to it. The board's report was accompanied by a typical cross section of the dam which it advocated and which was adopted. The height of the dam had been reduced 20 feet, or from elevation 135 feet to elevation 115 feet. The slopes on the upstream side are 1 on 7.67 to elevation 90, with a horizontal berm 30 feet wide at elevation 60, and then 1 on 4 to the full height, or 115 feet. On the downstream side slopes from the top down were fixed at 1 on 4 to elevation 90, thence 1 on 8 to elevation 60, from which to elevation 30, 1 on 16 was adopted. Below elevation 30, where a berm was provided, the slope was 1 on 8 to sea level. According to this cross section, which will be found in the annual report of 1909, the hydraulic fill was to extend to elevation 100, where it was to be 100 feet wide and topped by 15 feet of rock fill. On the upstream side the hydraulic fill was to have a slope of 1 on 2, and in the interval between this fill and a 10-foot thickness of rock on the outer slope of the dam was to be the "cheapest filling available." On the downstream side the hydraulic fill had a slope of 1 on 2 down to elevation 55, and thence to sea level on a slope about parallel to the slope of the dam, the interval between the fill and the exterior slope of the dam to be of the "cheapest filling available, rock fill preferred for surface of slopes."

The construction of the dam proceeded in accord with these recommendations, except that for construction purposes authority was given to continue the practically 1 on 8 slopes on upward, the change of slopes to be made later. The cheapest filling available was that supplied by the dredges, and it was evident that if this did not dry out properly a condition might arise which would result in producing such a head against the dry fill that a blowout might occur. Accordingly, in November, 1909, instructions were given to increase the quantity of dry fill on both the upstream and downstream sides, encroaching if necessary into the hydraulic fill so as to secure, outside of the latter, masses such that any hydrostatic pressure that might be produced by the hydraulic fill would tend to act downward on the exterior masses instead of upward and outward. The drying out that had been tried in the dry season of 1910-11 showed an unsatisfactory condition regarding the consolidation of at least the central portion of the hydraulic fill in that part of the dam east of the spillway, but it was believed that if construction proceeded along the lines of the instructions given the soft material would be squeezed out as the height of the dam increased.

In order to determine the settlement that was taking place in the dam, observations were required on hubs located as described in the last annual report and a monthly record kept. These observations showed a gradual settlement until on October 12, 1911, a movement occurred in the east half of the dam. On the north side, for a length of approximately 1,000 feet, the top of the dry fill settled 4 or 5 feet. This vertical movement was accompanied by a horizontal movement, greatest at the 75-foot contour, where it amounted to 14.2 feet, and gradually diminishing down the slope to the 31-foot contour, where the horizontal displacement was about 3.2 feet in a length of about 700 feet. While the crest of the slope moved downward, the lower portions of the slope were bulged upward to a certain extent, measurements showing a rise of 1.25 feet on the 60-foot contour at a point 1,150 feet from the center of the spillway channel. The movement was within the dam, as was verified by a test pit sunk where the bulging was greatest, which also showed that the masses of dry fill desired had not been secured. Material was piled to the north of the 31-foot contour, giving additional weight to the toe, and a blanket of spoil sufficient to make a continuous slope from the 31-foot berm to the top of the dam was placed over the north face. There was no motion after this additional weight had been added other than the gradual settlement. In addition to these steps, instructions were issued to pump sand into the hydraulic fill along the 1,000-foot length where the settlement occurred at the top, and to bring the dry fill up on the regular slopes, gradually crowding the hydraulic fill until the distance between the dry fills on the two sides was 25 feet, after which the hydraulic fill was to be covered with red clay secured from the vicinity and properly tamped wet until a height of 103.35 feet was reached, where the thickness would be 100 feet. It is proposed to continue observations and ultimately to bring the dam to 105 feet above sea level and, if necessary, subsequently to raise it to the height originally advocated.

A movement occurred about the same time on the south slope, the greatest lateral motion being 6.5 feet on the 75-foot contour. On the 60-foot berm there was a lateral movement of 0.5 foot. A heavy toe was added on the 60-foot level, extending from the dam to the spillway channel wall and to the berm.

In adapting the cross section proposed by the board in 1909 to the ground, the slopes were modified where the dam is practically a blanket over the spur projecting from the hills on the west side against which the dam abuts, and here the plan proposed of making the upstream slope 1 on 4 and the downstream slope 1 on 5 was approved. As dry fill was added on the upstream face of the hill a condition developed indicating that the material on the bottom extending out from the foot of the hill would not bear the weight, so

that it was necessary to flatten the slope, which was accordingly authorized to be 1 on 7.67. A heavy fill was placed on the ridge that was pushed up outside of the toe of this slope, and, in addition, one of the dredges operating to the south of the dam extended the foundation outside of the rock fill by distributing material over the bottom, thus adding to the spread given the foundations.

In the construction of the spillway work was confined during the first half of the year to the east and west flanks, where the abutments, ogee, and crest piers were completed to elevation 69, or the top of the dam. With the beginning of the dry season about two-thirds of the central section, which had been held at elevation 10 except for the construction piers, was inclosed with a cofferdam and the concrete work carried well above water level. The full closure was then made within the cofferdam covering the balance of the central section. Three Stoney gates and one cylindrical valve were installed to control the flow through the four undersluices. The program contemplated the completion of the central portion to elevation 50 by April 1, so that the lake could be allowed to rise to this height at the dam. This was done for the total length, except about 120 feet which remains at elevation 45, but this portion is to be built up to the required height in advance of the water reaching the 45-foot level. Though the gates controlling the undersluices were closed on April 30 and the lake allowed to rise, they were subsequently raised, as the non-completion of the lock gates did not permit the proposed lake level. The sluice gates were raised and lowered, depending upon circumstances, until August 17, 1912, when the condition of the lock gates was such that they could be closed. On this date the lake had reached a height of 32.01 feet. A trestle was built from the eastward at elevation 95 and a derrick erected near the west abutment to enable construction work on the east and west flanks to proceed during the first half of the current year. The total amount of concrete laid was 58,666 cubic yards, at a cost of \$7.0988 per cubic yard.

Plans prepared by the first division of the chief engineer's office for the hydroelectric power plant, which is to be constructed below the spillway, having been approved, excavation work was started by the Atlantic division in May, and the total amount accomplished during the year was 72,119 cubic yards, at an average cost of \$0.3767 per cubic yard. During the year 10,062 cubic yards of back fill, at an average cost of \$0.3898 per cubic yard, were placed about the spillway.

In the channel between Gatun locks and the Atlantic Ocean excavation in the dry was continued through the Mindi Hills and, with the exception of the dike separating the cut from the French canal, was completed on February 24, 1912. The sluicing operations reported last year were completed by the removal of 1,000 cubic yards

of mud, at a cost of \$2.5976 per cubic yard. Two steam shovels removed 56,703 cubic yards of earth and 368,169 cubic yards of rock at an average cost of \$0.5952 per cubic yard. When the dry excavation of the channel was completed the barrier was blown up, for which purpose 81,750 linear feet of drilling were done and 183,150 pounds of dynamite used. Of the amount of material removed from Mindi in the dry, about 350,000 cubic yards of rock were used for back filling at Gatun, the cost of dumping being charged to the locks.

The dredges which operated between the Mindi Hills and deep water in the Caribbean in excavating from the canal prism were the seagoing dredge *Caribbean*, 5-yard dipper dredges *Chagres* and *Mindi*, and the French ladder dredges *No. 1* and *No. 5*. They removed 3,859,445 cubic yards of earth and 495,595 cubic yards of rock. Channel silting during the year amounted to 3,036,000 cubic yards, making the net earth excavation in this section 823,445 cubic yards. Between Mindi and Gatun dredges *No. 4* and *Sandpiper* removed 515,787 cubic yards of earth south of the old Panama Railroad line. The total amount of dredging in the prism aggregated 4,870,827 cubic yards, at an average cost of \$0.2481 per cubic yard. In addition to the foregoing, material aggregating 883,918 cubic yards of earth and rock were removed just south of the locks, as already noted. Miscellaneous dredging outside of the prism included 3,762 cubic yards from the dry-dock slip, 72,798 cubic yards from the east diversion at Gatun, 23,496 cubic yards of earth and 872 cubic yards of rock from the east diversion at Mount Hope, 4,767 cubic yards of earth and 2,181 cubic yards of rock in front of the dynamite dock at Mindi, 80,296 cubic yards of earth from pit for rock dump north of Gatun Locks, 2,785 cubic yards of earth from in front of the fortification trestle at Mindi, and 2,450 cubic yards of earth from the slip at the cableways. The total output for the year from the canal prism and lock site aggregated 5,754,745 cubic yards, and from accessory works 444,327 cubic yards.

At the dry-dock shops the oxyacetylene and thermit welding processes were put in operation during the year, and the shops maintained the fleet of dredges, barges, and tugs in charge of the Atlantic division in working condition.

The breakwater extending out from Toro Point is intended for the protection of the harbor and the shelter of vessels against northers, and its line of direction is normal to prevailing winds during these storms. It is not intended to give protection against the waves produced by the trade winds, which generally are from the northeast. So far as the waves caused by the latter winds are concerned, it is the consensus of opinion among seafaring men that no shelter is necessary, and on this account the construction of the east breakwater, the commencement of which was postponed until

the effect of the west breakwater could be ascertained, has not been undertaken. It will not be required, so far as available data now at hand indicate, to protect the harbor or shipping in case of northers, though the actual occurrence of such a storm may demonstrate to the contrary. It will not be required by shipping against the trade winds or the waves produced by them. It may, however, be necessary in order to protect the channel against the silting that results both from the wave action and from the erosion of the bank which is now taking place on the shore of the bay west of the channel. It appears that the effect of the west breakwater is to increase the wave action on the beach at Colon, and it is possible that it may have some effect on the eroding process mentioned. What effect the mole being built for the protection of the new Panama Railroad wharves and adjacent anchorage basin at Cristobal will have is also unknown. The question is one of determining the relative cost of maintaining the channel by dredges, as compared with the cost of the breakwater. Another factor which enters into consideration is the final cost of the west breakwater. While the present indications point to the necessity of the construction of an east breakwater for the maintenance of the channel against silting, expenditures in this direction are not yet warranted.

During the past fiscal year 5,514 lineal feet of double track and 48 lineal feet of single track trestle were completed, making the total length of the trestle on July 1, 1912, 10,927 feet. Fill dumped from the trestle aggregated 460,040 cubic yards; in addition, 6,498 cubic yards were used for ballast and 4,680 cubic yards were furnished the fortifications, all of which was procured from the Toro Point quarry, which was shut down on June 22, 1912. Porto Bello rock for the exterior of the breakwater was delivered in August, 1911. The rock was shipped in barges, transferred to Lidgerwood trains by locomotive cranes, and plowed off on the north side of the trestle. During the year 65,133 cubic yards were unloaded in this way. Of the rock removed by the dredges from the canal prism, 510,780 cubic yards were dumped in the vicinity of the trestle. The cost of stone in the breakwater secured from the Toro Point quarry was \$1.3832 per cubic yard; that from Porto Bello was placed at a cost of \$4.6445 per cubic yard.

The filtration plant which was authorized for the Agua Clara Reservoir in January, 1911, was completed on December 29, 1911, at a total cost of \$39,138.95. Due to shortage of water in Colon, Toro Point, and Porto Bello, water was transferred from the Gatun water supply in barges, from January 25 to May 23 to Toro Point, from May 10 to June 24 to Cristobal, and from May 9 to 16 to Porto Bello.

During the year the usual maintenance work was done on roads, sewers, and drains. Approximately 10,000 square yards of macadam were laid and repaired, 15,000 lineal feet of road ditches cleaned, 2,800 lineal feet of curb and gutter laid, and 3,000 feet of sewers installed. In addition, municipal improvements were carried on in Colon under an appropriation by Congress for the purpose.

Sanitary work consisted of cleaning and grading 336,000 linear feet of ditches; constructing approximately 8,000 linear feet of ditches, and lining with concrete approximately 2,300 linear feet of ditches.

For further details, attention is invited to Appendix B.

CENTRAL DIVISION.

The work of this division embraces all the excavation between the Gatun Dam and Pedro Miguel Locks, including diversion channels, the construction of the Naos Island breakwater, clearing the timber from the channel and anchorage basin, municipal improvements in the various settlements included within the division limits, and such sanitary engineering work in the same area as is prescribed by the sanitary department. The work is in charge of Lieut. Col. D. D. Gaillard, United States Army, as division engineer.

The division is divided into four construction districts, as outlined in the last annual report.

The Chagres district extends from the Gatun Dam to the Chagres River at Gamboa, in which distance the Chagres River crosses the axis of the canal 23 times, thus forming a series of peninsulas which, beginning at Gamboa, are known as Point 1, Point 2, Point 3, etc. The material which remained to be removed July 1, 1911, in Point 1 consisted of gravel and sand carried down by the Chagres and deposited in the channel that had been excavated through this peninsula. In all 91,300 cubic yards of material were removed from this locality during the fiscal year just ended, of which 27,632 cubic yards were taken from the canal prism and the balance, 63,668 cubic yards, outside of the prism. The gravel removed was stored for use as ballast and in concrete work. The total amount in storage at the close of the fiscal year was 110,000 cubic yards.

No work was done at Points 2, 3, and 4; the material remaining to be removed consists of silt aggregating 58,300 cubic yards; it is intended to take this out by a suction dredge during the current fiscal year.

At Point 4—B 56,380 cubic yards were removed during the fiscal year; of this, 44,184 cubic yards were taken out by contract. A contract was entered into on December 6, 1910, for excavating about 112,450 cubic yards, at a cost of \$0.2150 per cubic yard; afterwards

increased to \$0.3150, but little was done at the new rate. Work was begun in December, 1910, and on May 16, 1912, after removing 108,992 cubic yards, the contractor signified his inability to finish it. The work was therefore taken over and 12,196 cubic yards removed by the forces of the central division. There remained to be removed by dredges on June 30, 1912, 2,700 cubic yards.

At San Pablo the completion of the channel required the removal of the bed of the old line of the Panama Railroad, which could not be done until this line was abandoned. Work was commenced in January, 1912, and completed in May by the removal of 305,291 cubic yards, which finished the prism at this locality.

At Tabernilla excavation was commenced in March, 1912, and finished the same month by the removal of 22,893 cubic yards.

At Buena Vista 100 cubic yards were removed in March, thereby completing this part of the work.

At Bohio steam-shovel excavation was commenced in February, 1912, and finished in March; 6,997 cubic yards were removed.

At Pena Blanco 48 cubic yards were removed in March, 1912.

A contract for the removal of about 202,140 cubic yards between Tabernilla and Bohio was entered into on March 21, 1910. Work was commenced in October, 1910, and the contract completed in April, 1912, by the removal of 207,132 cubic yards, of which 101,600 cubic yards were removed during the present fiscal year, at a cost of \$0.34 per cubic yard.

The excavation of the Panama Railroad embankment across the anchorage basin south of Gatun was commenced in March, 1912, and finished to grade 35 feet above sea level in the following month, and required the removal of 39,568 cubic yards.

A small force was engaged in blasting stumps and trees in the Gatun Lake Channel. The total amount expended for this work was \$2,029.51. Prior to August 31, 1911, this division also did the clearing work for the first division in connection with lighting the channel. The total clearing was 652.7 acres at \$21.1390 per acre, involving running 49,547 feet of profile and cutting 163,310 feet of trochas at a cost of \$0.0990 per lineal foot. Subsequent to August 31 this work was handled by forces under the first division of the chief engineer's office.

The total amount removed in the Chagres section during the year aggregated 560,509 cubic yards, leaving 151,000 cubic yards of wet excavation still remaining.

During the fiscal year 16,476,769 cubic yards of material were removed from the Culebra Cut and, from estimates prepared on July 1, 1912, 11,863,540 cubic yards remained to be removed in order to complete this section of the canal. The amount remaining was again increased over that reported a year ago by 3,595,000 cubic yards, in

order to allow for slides already existing at the beginning of the fiscal year and for excavation along the upper levels of the banks of the canal, where slides had developed or were anticipated, and outside of the canal prism lines. The total amount of material removed during the year outside of the slope lines and because of slides aggregated 5,915,000 cubic yards, or 35.90 per cent of the total amount of material removed from the cut as against 30.07 per cent during the previous fiscal year. The total amount of material due to slides so far removed aggregates 16,671,000 cubic yards, and the estimated amount remaining is 3,595,000 cubic yards. The work in the cut has been retarded on account of slides and breaks in its banks which increased as the cut was deepened. The geological formation changes so frequently and suddenly that no treatment for slides has proven effective, when once developed, except that of excavating and hauling away the material composing the moving mass until the slide comes to rest or until the angle of repose for the particular material in motion is reached. At the Cucaracha slide, which has been practically at rest for over a year, the angle of repose is somewhat steeper than 1 on 5, while the Culebra slide on the west bank, where the material is still moving, the present slope is about 1 on 5. In the slide on the west bank of the canal just north of the village of Culebra, the moving material is of stratified rock moving in mass on a layer of lignite which has an inclination of 1 on 7. This slide developed early in the dry season. These very flat slopes of the bank in the deepest portions of the cut explain the large amount of material added by slides and breaks over the original estimates. A number of relatively small slides developed as the cut was deepened, but the largest one now in motion is that which results from a break in the west bank of the canal at Culebra and covers an area of about 63 acres. From this slide 2,710,000 cubic yards were removed during the fiscal year just ended, making a total thus far taken out of 6,765,000 cubic yards, and leaving still to be handled an estimated amount of 1,300,000 cubic yards. The next largest slide lies on the east side of the cut, opposite Culebra, and covers an area of 50.7 acres. From this slide 1,960,000 cubic yards were removed during the past fiscal year, making a total of 4,290,000 cubic yards that have been taken out since it started, in 1907; it is estimated that 600,000 cubic yards still remain.

Work, begun in January, 1911, of decreasing the pressure on the banks where breaks might be expected was continued throughout the year, three steam shovels having been kept continuously at work terracing the west bank in the vicinity of Culebra, and the same number during the greater part of the year on similar work on the opposite bank. By removing the weight from the top of the banks there is less trouble and expense in maintaining the tracks at the

bottom of the cut and less interference with drainage, two important considerations in prosecuting the work economically and expeditiously.

With the hope that it may allay some misapprehension which seems to be felt concerning the slides which are given sensational importance whenever any occur, attention is invited to a report on the subject prepared by Mr. Donald F. MacDonald, geologist, and given in Appendix E.

Thus far increases in the estimates of material to be removed, made necessary by the slides, will cause no increase in the total estimated cost of Culebra Cut, as the division costs were reduced during the past year, effected in part by increased efficiency of the organization, by the fewer interruptions in the transportation service by slides and water, by the better conditions generally of the dumps, and by the upkeep of the output, due to the amount removed by the shovels on the upper reaches. It is also of interest to note that none of the slides which occurred during the year would have interfered with the passage of ships had the canal been in operation.

The summit of drainage in the cut is about opposite Culebra, and water south of this point was drained into the Pacific by pumping from a sump at Pedro Miguel until August 15, 1911, when arrangements were perfected for draining through the central culvert of the Pedro Miguel locks. The dike separating the cut on the north side from the Chagres River remained intact, and the pumping plant previously described continued in service to handle the water which drains to the north from the summit.

The diversion channel on the east side of the cut, for carrying the waters of the Obispo River and its tributaries, gave trouble during the year. In March, 1912, cracks appeared to the south of Empire suspension bridge, indicating a motion of the material lying between the diversion and the cut proper. Steps were taken to relocate this part of the diversion farther to the eastward, so that should a slide occur the waters of the diversion would not pour into the cut and interfere with work. Excavation was begun in April and finished during that month; in all, 26,168 cubic yards were removed; and the new portion is 1,970 feet long and located 510 feet east of the old diversion at its most distant point. The Empire-Paraiso wagon road and the railroad were reconstructed on the west bank of the new diversion. When the water was turned into the new channel the weight of the threatening bank was lightened by removing the material between the old portion of the diversion and the face of the cut. The slide on the east side of the canal, opposite Whitehouse, threatened to break back into the Obispo diversion at that point. While the movement of the material was slow, it was deemed safer to relocate the diversion about 100 feet eastward of its present loca-

tion, and work with this in view was undertaken toward the close of the year. It will require about 500 feet of trestle and the removal of about 15,000 cubic yards of earth.

All trains loaded in the cut were hauled out at either end to the dumps. The dumps used for wasting material from the canal proper after February 15, when the service to Gatun was discontinued, were those at Miraflores and Balboa for trains run to the south, and the relocation dumps for trains run to the north over the Chagres River bridge. The material excavated from the high levels on both sides of the canal was wasted on local dumps, with the exception that a few of the Lidgerwood trains serving shovels at Rio Grande and Culebra were run over the Panama Railroad to the dumps at Miraflores and Balboa. For finishing the work at San Pablo, three old dumps were reopened and two new river dumps utilized. The Tabernilla dumps were reopened and used during March, 1912, for wasting a part of the material excavated at that point. Between the Balboa Y and Ancon and Sosa Hills 72 acres of marshy land that could not be drained properly were filled in, 1,022,591 cubic yards of material from the canal being used for this purpose. As this fill is for sanitary purposes, the excess cost of dumping over the average cost of dumping at Balboa is not included in the cost of the central division, but is held in a suspense account to be distributed later, depending upon the use to which the land may be put. Of the spoil hauled from the central division, 1,585,184 cubic yards were sent to Gatun for use on the dam in back fill of the locks; 2,872,950 cubic yards were wasted at Miraflores; 3,930,543 cubic yards were used at Balboa, partly in reclaiming swamp, partly in extending the breakwater, and the rest wasted; 5,268,890 cubic yards dumped along the relocation between Caimito and Gamboa.

In addition to the amount wasted on the central division dumps, which aggregated 15,259,391 cubic yards, 1,883,676 cubic yards were furnished other divisions. The material previously wasted at Miraflores, Balboa, and on the relocation dumps having settled firmly, it was found more economical to place a new layer or form a new dump on top of them than to start new ones.

The Naos Island Dike or Breakwater is to extend from the shore at East Balboa to Naos Island, a distance of 3.29 miles from the mainland, and is constructed for the purpose of cutting off silt-bearing currents from the excavated channel in the Pacific, thereby reducing the cost of maintenance and making navigation of the channel easier by eliminating the cross currents. In constructing the dike, a pile trestle is being driven toward the island from which material is dumped. Prior to June 30, 1911, the trestle had been constructed for a total distance from the shore line of 2.78 miles. During the fiscal year this trestle was extended 1,360 feet, giving a total length of

trestle constructed to June 30, 1912, of 16,051 feet, or 3.04 miles. The length of the trestle on June 30, 1912, was 1,320 feet from Naos Island, and the fill was extended to within 2,000 feet of its end, or 3,320 feet from the island. Much trouble was experienced during the past two years in extending the fill, due to the sliding of the bottom under pressure, caused by the weight of the stone dumped from the trestle. The total vertical settlement at one locality on the dike during the year aggregated 125 feet. The elevation of the top of the trestle is 14 feet above mean tide, and the average depth of water for the last mile of trestle constructed is about 15 feet at mean tide, giving a total height of trestle of about 29 feet above the original bottom. When the rock is dumped from the trestle it begins to settle as soon as it attains a height of a few feet, displacing adjacent material which, pushing up, forms a parallel ridge of mud. By the time the rock fill has been completed to full height these parallel ridges are about 80 feet from the center of the track. Experience shows also that the trestle is pushed out when the fill reaches the height of mean tide and cuts off communication beyond the break. To lessen the difficulties and to spread the foundations as much as possible, suitable material removed by the dredges in the channel was dumped in front of the trestle and spread for a considerable distance on either side of the center line. A board appointed to submit a plan for hastening progress on the construction of this breakwater recommended the building of a double trestle, dumping on either side, thereby spreading the fill and continuing the fill to mean tide out to the island, thereby saving the trestle, which is to be made more substantial than formerly. When the fill has been extended to the island it is to be carried to full height, commencing at the island; should a break then occur in the trestle, there would be considerable length of it left to fill over. This was approved, and the double trestle is being built. The total amount expended on the dike by the central division up to June 30, 1912, was \$186,396.79. As the work when completed will be a benefit to the channel excavated south of Balboa, the Pacific division pays for the cost of the trestle, which has amounted to \$70,558.01.

The average division cost of excavation for the year, including plant charges and all items which entered into its accomplishment, was \$0.5101 per cubic yard.

The Empire machine shops continued under charge of the central division, making shop repairs and manufacturing repair parts for the steam shovels in use on the canal, until the close of the fiscal year, when they were transferred to the mechanical division. During the year 20 steam shovels were repaired in the shops. The night repair gang was continued for field repairs on the shovels, and the average number repaired in the cut each night was 14.

The construction of the Empire-Chorrera Road, which was commenced in April, 1911, was continued throughout the year. On June 30, 1912, macadam had been laid and rolled on 11,230 lineal feet. In addition to this, subgrading, including necessary concrete culverts and drains, was completed for a distance of 12,450 lineal feet. This is a 16-foot macadam road and will extend from the village of Empire to the Zone boundary, a distance of about 6 miles, and the Panama Government has promised to extend it to Chorrera.

The Empire-Paraiso Road was relocated for a distance of 2,480 feet and reconstructed. This was made necessary by the slide on the east bank of the canal.

In the village of Culebra 1,400 feet of road were reconstructed, on account of slides on the west bank of the canal. In the village of Golden Green 1,650 feet of road were constructed.

In December, 1911, it was realized that it would be necessary to install auxiliary pumps in the Chagres to assist the reservoirs in furnishing a sufficient amount of water for general use in the central division until such time as the rainy season should replenish the supply. Purchase was made of two 3-stage centrifugal pumps, belt driven, with a rated capacity of 2,000,000 gallons under a working pressure of 150 pounds, and they were installed under the Chagres River bridge and put into service on January 24, 1912, acting as feeders for the mains on the east and west banks of the canal. During the latter part of February, on account of draining off the supply in the Carabali reservoir, the Chagres River pumping station was operated to supply water to the Gorgona shops for mechanical purposes. On March 12 a 6-inch line was completed connecting the Gorgona and Gamboa systems, supplying water to the Panama Railroad tank at Matachin, the town of Matachin, Jamaicatown, and the engine house at Gorgona shops. On April 18 an additional piston pump was installed on the Sardanilla River, which increased the supply for canal purposes at this point to 400,000 gallons per day. On June 8 a piston pump having a capacity of 1,500 gallons per minute under a working pressure of 250 pounds was procured from the Atlantic division and was installed by the date that the supply in the Camacho reservoir was exhausted. An underwriters' fire pump procured from the subsistence department was also installed in the Chagres River.

Sanitary work consisted of digging 5,763 lineal feet of ditches; regrading 311,061 lineal feet of ditches; cleaning 1,613,820 lineal feet of ditches; laying 550 lineal feet of tile drains; constructing 11,650 lineal feet of concrete gutters; cleaning 341,214 lineal feet of concrete drains; and clearing 6,536 square yards of brush and grass.

For further information concerning the operations of the central division, attention is invited to Appendix C.

PACIFIC DIVISION.

The work of this division consists of the construction of the locks and dam at Pedro Miguel, the locks and dams at Miraflores, the Ancon quarry, dredging for sand at Chame, excavating a channel between the locks and below Miraflores Locks to deep water in the Pacific, municipal work in Panama and within the various settlements within the territorial limits of the division, and such sanitary engineering work as may be prescribed by the sanitary department within the same area. In addition, excavation necessary to prepare for work on the terminals, including coaling station, dry dock, and machine shops, was placed under this division. The work is in charge of Mr. S. B. Williamson as division engineer.

The excavation for the Pedro Miguel Locks, which was reported as completed at the end of the previous fiscal year, was extended to include 95,156 cubic yards removed during the last year from the French dump east of the site, making the total amount of excavation done by this division for Pedro Miguel Lock 1,130,236 cubic yards, exclusive of the material removed in preparing the foundations. The cost of the work during the last year was \$0.3018 per cubic yard. In preparing the lock foundations, which consisted of removing material below floor level in order to secure footings for the walls, foundations for lateral culverts, sills, and sumps, 38,826 cubic yards were handled at a cost of \$2.1715 per cubic yard. A large portion was removed with picks and shovels and loaded into skips which were handled by locomotive cranes or derricks into cars. Steam shovels were employed wherever practicable.

At the beginning of the fiscal year the construction plant had been moved to Miraflores, with the exception of two chamber cranes. The dismantling of these began on December 12 and February 7, respectively. The total amount of concrete laid during the year at Pedro Miguel was 182,870 cubic yards, mixed entirely by the auxiliary plant, which consisted of one 2-yard mixer located at the south end of the east wall until September 25, two 2-yard mixers installed at the south end of the west storage trestle in the forebay, one of which was moved on March 15, and an average of 3.16 one-half yard mixers, which were moved about as considered most advantageous. Prior to dismantling, the chamber cranes handled 28,450 cubic yards of concrete supplied by the auxiliary plant and were also engaged in setting ironwork and filling the center wall. The remaining 154,420 cubic yards were handled either by locomotive cranes and derricks or poured into forms from the one-half yard mixers. The auxiliary mixers operated on an 8-hour-day basis and produced 36.12 cubic yards per mixer per hour working time and 20.96 cubic yards service time. The total yardage for the year was made up of 134,193 cubic yards

of plain concrete, at an average cost of \$5.7183 per cubic yard, and 48,677 cubic yards of reenforced concrete, at an average cost of \$8.5195 per cubic yard. Revised estimates made on July 1, 1912, showed an increase of 61,761 cubic yards in the total amount of concrete previously estimated for these locks. The amount placed to June 30, 1912, was 847,926 cubic yards and the estimated amount remaining was 51,150 cubic yards.

Back filling behind the side walls was continued throughout the year, and a total of 371,212 cubic yards were placed, of which 186,518 cubic yards were back of the east wall, 162,757 cubic yards back of the west wall, and 21,937 cubic yards in the center wall. The cost of the back fill of the main walls averaged \$0.3535 per cubic yard and in the center wall \$0.9633 per cubic yard.

The drainage from the central division was turned through the culvert in the center wall at Pedro Miguel on August 15, which permitted the resumption of building the west dam, and 321,589 cubic yards were added during the year, at a cost of \$0.5040 per cubic yard. The dam is 87 per cent completed. The excavation for the concrete core wall, to connect the dam with the wing wall of the lock, was begun and is 95 per cent completed; the amount of material removed was 3,937 cubic yards, at a cost of \$1.5026 per cubic yard.

At Miraflores excavation of the lock pit was continued, and resulted in the removal of 624,747 cubic yards, exclusive of that for preparing foundations. Of the amount excavated, 120,351 cubic yards were of earth and 504,396 cubic yards were of rock. The average cost for lock excavation was \$0.6566 per cubic yard. Of this total, 364,767 cubic yards were used for back filling and 259,980 cubic yards were placed in the toes of the west dam. The surface of the rock on which the Miraflores Locks are founded dips rapidly at the north end of the site. The walls were originally located with their northern extremities on rock which was only a few feet above the desired grade. After the excavation for the locks had been begun, changes in design necessitated extending the walls 98 feet farther north, thereby not only increasing the amount and depth of excavation required to secure suitable foundations, but adding materially to the difficulties and cost, in that the additional work had to be done in a confined space below the surface water level, and it was necessary to remove a number of construction tracks which had been located according to the original plan. In performing this work and preparing the lower lock foundations 165,145 cubic yards were removed, of which 26,832 cubic yards were of earth and the remainder of rock. The average cost was \$1.5677 per cubic yard.

The construction plant, consisting of four berm and four chamber cranes, was described in the annual report of 1910, but the arrangement of cranes at Miraflores was changed since that report because

of slides which developed at both the east and west sides of the lower lock. These interfered with the movements of the berm cranes, necessitating a different system of handling made possible by utilizing the construction locomotives and cars which had been used in connection with the plant at Pedro Miguel and no longer required at this locality. The slide at the lower end of the lower west chamber has been the source of greatest difficulty, has delayed the construction of the west wall, and materially increased the cost. Instead of erecting two chamber cranes in each lock, as was originally proposed, and supplying them with concrete for the center wall from the berm cranes, the four cranes were placed in the east chambers, two erected in the upper and two in the lower locks. The cantilevers occupy such a position that the longer arms extend entirely over the center wall instead of as indicated in the report for 1910. In addition, the supply of concrete is not furnished by the berm cranes, as originally intended, but by stationary mixing plants—two in number—one in the east wall of the upper lock and one in the east wall of the lower lock, each containing two 2-yard mixers. The concrete is delivered from the auxiliary mixers to the chamber cranes by narrow-gauge equipment operating over tracks laid on the lock floors. After completing the upper lock walls one of the chamber cranes was taken to the lower level, and at present there are three operating on the level of the lower lock.

On June 30, 1911, there were two berm cranes in operation at Miraflores, and the other two were put in commission on July 25 and October 28, respectively. They handled the concrete for the side walls, forms, and irons, and worked on a basis of an 8-hour day, except from December 21 to May 11, and from May 15 to June 8, when two cranes were operated on a basis of a 12-hour day. One of the cranes was operated 12 hours at various times, aggregating 17 days. They averaged 9.65 hours per day throughout the year. The eight mixers connected with them produced 409,651 cubic yards of concrete, at the rate of 38.06 cubic yards of concrete per mixer per hour of actual time working and 21.24 cubic yards per mixer per hour of service time. During the past year these cranes, while in service, were engaged 55.49 per cent of the time in mixing and placing concrete, and 6.51 per cent in handling forms, steel, or other material, the rest of the time being taken up in making repairs, 5.54 per cent; waiting for forms, 14.04 per cent; moving crane, 8.52 per cent; and other delays, 9.90 per cent.

The four chamber cranes were assembled and began placing concrete, handling forms, and steel on July 13, August 3, February 15, and March 26, respectively. The chamber cranes handled 234,520 cubic yards of concrete and 7,342 cubic yards of filling for center wall. They were operated on a basis of an 8-hour day, with the

following exceptions: Two cranes worked 10 hours from September 21 to October 13, 1911; one crane worked 12 hours from March 5 to March 31; and two cranes from April 1 to June 30, 1912; an average of 10.23 hours per crane per day during the year. They placed an average of 58.38 cubic yards of concrete and filling per hour actual working time, and they averaged 32.30 cubic yards of material per hour in service, consuming at this work 55.34 per cent of the total time in service. During 9 per cent of the time in service the cranes handled forms and other material, and delays amounted to 45.66 per cent, 14.58 per cent of which was waiting for forms.

The two auxiliary 2-yard mixers installed in the east wall of the upper locks supplied concrete until June 15, 1912, and from May 8 two 2-yard mixers installed on the east wall of the lower locks were operated, making an average of 2.09 mixers of this size for the year. They produced 253,450 cubic yards of concrete and operated on the same time as the chamber cranes, averaging 10.18 hours per day, or at the rate of 66.33 cubic yards of concrete per mixer per hour working time and 40.29 cubic yards service time.

In addition to the regular plant an average of 4.24 $\frac{1}{2}$ -yard portable mixers were used throughout the year, mainly in constructing the walls of the forebay and the upper reenforced concrete approach pier.

The total amount of concrete placed in the Miraflores locks during the past year was 751,540 cubic yards, made up of 729,096 cubic yards of plain and 22,444 cubic yards of reenforced concrete. The construction and auxiliary plants placed 401,079 cubic yards and 350,461 cubic yards, respectively. The total amount of masonry laid in the locks on the Pacific side was therefore 934,410 cubic yards and 174 cubic yards in the wing walls. The average cost of the concrete placed was \$4.5867 per cubic yard of plain concrete and \$10.6388 per cubic yard for reenforced concrete.

The total amount of concrete laid in the Pacific division locks to July 1, 1912, aggregated 1,874,029 cubic yards, at an average cost of \$5.0264 per cubic yard. There remained to complete the locks 51,150 cubic yards at Pedro Miguel, as already noted, and 386,729 cubic yards at Miraflores; in addition, there will be required to complete the cut-off walls at Pedro Miguel 3,000 cubic yards and the dam at Miraflores 75,000 cubic yards.

Backfilling the lock walls was continued with material from locks and prism excavation below the locks, and 450,686 cubic yards were placed during the year, of which 315,487 cubic yards were placed back of the east wall, 127,287 cubic yards back of the west wall, and 7,912 cubic yards in the center wall, at costs of \$0.4174 per cubic yard for that back of the side walls and \$1.0126 per cubic yard for that in the center wall.

The crushed stone for concrete in the Pacific locks was obtained from the Ancon quarry which, with the crusher plant, was operated throughout the year. For the most part, the operation was on the basis of a 9-hour day, but for the last few months it was necessary to put on a night shift for a week or two at a time in order to supply the demand. The total amount produced by the plant was 839,279 cubic yards, at a cost of \$0.6720 per cubic yard in the bins. The crushers produced 252.76 cubic yards per hour service time and 351.50 cubic yards per hour actual working time. Of the total amount crushed, 782,818 cubic yards were placed in the storage piles for use at the locks, 31,467 cubic yards were used in other work under charge of the division, 21,642 cubic yards were sold to other departments and divisions, and 3,352 cubic yards were used in municipal work. The cost of stone delivered in the stock piles at the locks was \$0.7996 per cubic yard.

Sand for the lock masonry and other concrete construction was obtained from Chamé Bay, located about 20 miles west of Balboa. It is secured by dredging, thence loaded into barges, towed to Balboa and transferred to bins by rapid unloading cranes. Of the three electric cranes two were operated eight hours per day and one held in reserve. During the year 564,837 cubic yards were unloaded, or an average of 115.94 cubic yards per hour in service, or 161.41 cubic yards per hour working, at an average operating cost of \$0.1177 per cubic yard, exclusive of charges for plant. From the bins it is loaded by gravity into cars and transported to the storage piles at the lock sites or to such other points as may be desired. The total amount produced during the year was 564,837 cubic yards, at a cost of \$0.5107 per cubic yard delivered in the bins. Of this amount, 509,587 cubic yards were placed in the storage piles for use in concrete, 34,394 cubic yards were delivered to the Atlantic division, and 20,856 cubic yards were delivered to other divisions. The cost of the sand in stock piles was \$0.7025 per cubic yard.

The hydraulic fill in the west dam at Miraflores was completed on December 4, 1911, and contains 625,048 cubic yards, of which 78,316 cubic yards were pumped into the dam during the past year.

Dry filling was continued throughout the year; 425,125 cubic yards were placed, at an average division cost of \$0.4044 per cubic yard. The dam is 87 per cent completed and the remaining work consists in connecting the north end of the present work and the lock wall over the space now occupied by the west storage trestle and train tracks.

Excavation of the channel by steam shovels between Pedro Miguel and Miraflores and south of the latter was continued; 864,475 cubic yards were removed during the year, of which 411,987 cubic yards

were of earth and the remainder of rock. The average cost was \$0.7527 per cubic yard.

The hydraulic excavation plant was in operation throughout the year in the sea-level section of the canal south of Miraflores and excavated 900,596 cubic yards of material. Of this amount, 78,316 cubic yards were dumped into the west dam at Miraflores and 822,280 cubic yards were deposited in the swamps east of the canal prism. The total cost of handling this material, earth and rock, was \$0.5564 per cubic yard. The material deposited on adjacent swamps reclaimed 76 acres of tidal swamp land east of the prism.

The dredges operating in the canal during the year below Miraflores were the 20-inch seagoing suction dredge *Culebra*, the 5-yard dipper dredge *Cardenas*, three French ladder dredges, and, for a period of three months at the close of the fiscal year, the new ladder dredge *Corozal*. Operating in the prism the dredges worked between stations 2100 and 2236, or for a stretch of 13,600 feet, the lower end of which is 1,855 feet north of the French dock. During the year the dredges removed 4,683,902 cubic yards, at an average cost of \$0.19 per cubic yard. Of this amount, 3,884,287 cubic yards were removed from the channel, including about 1,044,203 cubic yards in maintaining the channel, and 799,615 cubic yards outside of the canal prism in the vicinity of the terminals at Balboa, in maintaining the berth at the sand dock, and in excavating a channel to Flamenco Island. Of the latter amount, 370,607 cubic yards were removed from the area of the basin in connection with the terminals on the Pacific side. The ladder dredges could not dredge economically on account of the depth of water at high tide, and rather than tie them up they were worked in this area pending action by Congress on recommendations relative to terminals. There remained at the close of the fiscal year to complete the excavation in the channel 4,194,059 cubic yards, including 700,000 cubic yards estimated allowance for silting.

South of station 2142 the rock that must be removed in order to secure the required depth lies in separate shoals of relatively small area and volume, and the rock is broken up for dredging by drilling under water with a drill scow and breaking below water with a Lobnitz rock breaker. Three drills were operated on the drill barge, on two 10-hour shifts, and covered an area of approximately 236,082 square feet, through which 153,819 lineal feet of holes were drilled. Of the amount broken up, 160,903 cubic yards were removed by dredging. By the rock-breaker method the area covered was approximately 563,617 square feet and the depth of penetration averaged 3.69 feet. The amount dredged from the area thus broken aggregated 77,156 cubic yards.

The dredge *Corozal* is a self-propelling center ladder dredge designed to excavate mud or sand at the rate of 1,200 cubic yards per

hour from a depth of 50 feet and to discharge the spoil directly into hoppers of 1,020 cubic yards capacity or into barges alongside. Two sets of 39 buckets are provided, one set with a capacity of 54 cubic feet per bucket for use in soft material and the other set with a capacity of 34 cubic feet per bucket to be used when digging rock. The dredge was delivered by the contractors at Balboa on March 27, 1912.

No equipment was assembled or erected during the year at the Balboa shops and shipways. All necessary running repairs were made to the plant and floating equipment at these shops. The equipment, in addition to the dredges already enumerated, consisted of 5 tugs, 6 clapnets, 7 dump scows, and 6 sand and 4 service barges.

In addition to the municipal improvements carried on in Panama under a separate appropriation made by Congress, municipal improvements consisted in replacing the 16-inch main from Rio Grande Reservoir by a 20-inch main at a cost of \$158,562.87. The 16-inch pipe from the reservoir to the Pedro Miguel Locks was left in position, where, together with the 20-inch main, it is connected to a 24-inch pipe embedded in the emergency dam sills. Both mains were again connected on the east side of the locks and the double line extended to within 2,490 feet of the Ancon pumping supply. This was done not only to insure the supply and pressure at the south end of the system, but to avoid changing a large number of temporary connections already made for construction work with the 16-inch line. A second 10-inch line from the Cocoli pumping station to the main at Miraflores was also added. The Cocoli pumping and filtration plant, which was installed for the purpose of pumping water from the Cocoli Reservoir to make up the deficiency in the Rio Grande supply, was increased by the addition of two pumps. They are 3-stage, motor-driven centrifugal pumps, with a capacity of 1,500 gallons per minute each against a head of 300 feet, and are direct-connected with 200-horsepower, 3-phase, 25-cycle motors.

The reenforced concrete dock constructed for the Panama Railroad Co. by the Pacific division and described in the last annual report was completed during the year, including the back filling. The dredging in front of the wharf, aggregating 1,005,983 cubic yards, is not yet completed, but was advanced sufficiently to permit docking vessels for a length of 575 feet. Forty-five caissons were sunk to rock, the greatest depth found being 64.08 feet below mean tide and the least depth 52 feet below mean tide. The total cost of the dock was \$351,741.39.

Borings were made over the area to be occupied by the dry docks, coaling station, terminal docks, and machine shops, and, based on these, permanent locations were selected.

Sanitary work consisted in cleaning 654,531 linear feet of earth drains; excavation of new earth drains, requiring the removal of 3,274 cubic yards of earth; sweeping 627,009 linear feet of cement drains; filling swamps and holes at various points, necessitating the handling of 975 cubic yards of material; laying 270 linear feet of tile drains; constructing 5,164 linear feet of cement drains; and clearing $112\frac{3}{4}$ acres of vegetation.

For further information concerning the operations of the Pacific division, attention is invited to Appendix D.

MUNICIPAL IMPROVEMENTS IN COLON AND PANAMA.

The act of March 4, 1909, making appropriations for the canal, included an item of \$800,000 for extending the municipal improvements in Colon and Panama, to enable the growth of the cities beyond the areas the improvement of which was undertaken in 1905. The amount expended in the two cities will be added to the indebtedness previously incurred for this purpose, to be refunded through the collection of water rents at the end of the 50-year period.

Of the money appropriated, the sum of \$550,000 was allotted for work in Colon, which was to be expended in the construction of the D Street storm sewer and filling in to the east of D Street, so as to give the height of 8.5 feet above sea level at the intersection of Ninth and E Streets, grading down to the elevations reached by the former improvements. Work was continued during the fiscal year, the suction dredge continuing operations until August, 1911, when it had added 129,939 cubic yards of material (borrow pit measurement) to that laid during the previous fiscal year, at an average division cost of \$0.3533 per cubic yard, exclusive of the charge for plant. The total fill actually placed amounts to 585,527 cubic yards, showing a loss of 29.33 per cent from borrow pit measurement due to waste and consolidation. The average cost was \$0.2999 per cubic yard. This fill was for lots as well as streets, the former paid for by the property owners, in this case the Panama Railroad Co., so that \$52,311.52 were chargeable to the appropriation.

In addition to the fill, 9,826 lineal feet of water mains and 9,603 lineal feet of sewer lines were laid, 3,931 square yards of macadam added in surfacing D Street, 40,794 square yards of macadam laid in improved areas, including 1,560 square yards of resurfacing on other streets, 21,440 lineal feet of curb and gutter built, 1,590 square yards of concrete alleys, and 1,341 square yards of sidewalk constructed. Due to settlement, 2,015 lineal feet of curb and gutter were replaced. Chamé sand was used for concrete, and, except a small quantity from Ancon quarry used early in the year, the stone was from Porto Bello, from the cost of which the plant charge was

deducted. During the year \$84,528.41 were expended, making the total cost of improvements to June 30, \$451,970.39.

Of the amount appropriated by Congress, \$250,000 were allotted for improvements in the city of Panama. The work at first undertaken was completed. Survey and plans were made for developing the district bounded by the Zone Line Road, B Street, Fourth of July Avenue, and West Sixteenth Street, and the money was to be advanced by the Government of Panama in accordance with an agreement that the cost of all further municipal improvements in the two cities will be paid for by that Government. As the Government was unable to do this, as the improvements were required for sanitary purposes, and as there was an unexpended balance of the amount allotted for work in Panama, authority was given to make the improvements in accordance with the plans, and the work performed during the past year comprised grading and macadamizing streets, placing concrete curbs and gutters, and laying water mains and sewers in the portions of the city specified, as shown in the following table:

Improvements.	Ancon Boulevard.	Extension Avenue A.
Paving.....square feet..	170,337	3,332
Curbing.....lineal feet..	17,004	272
Sewer mains.....do....	4,040	.....
Sewer laterals.....do....	1,515	.....
Water mains.....do....	4,347	.....
Water laterals.....do....	1,674	.....

The amount expended during the fiscal year was \$38,745.05 and the total cost of the improvements in the city of Panama was \$228,105.68.

For further details in connection with this work, attention is invited to Appendices B and D.

SECOND DIVISION, CHIEF ENGINEER'S OFFICE.

This division has charge of all mechanical questions that may arise and supervises expenditures and allotments for the work. The third division of the chief engineer's office was abolished on January 24, 1912, after the resignation of Mr. C. M. Saville, assistant engineer formerly in charge, and the work transferred to the second division. To this division was also assigned the design of the dry dock, coaling stations, shops, and appliances in the form of harbor tugs, cranes, and barges. The division is in charge of Mr. H. H. Rousseau, United States Navy, as assistant to the chief engineer.

On the assumption that favorable legislation would be provided, general and detailed plans of the terminals were undertaken with a

view to beginning work of construction as soon as funds should become available. The general layout of the terminals at the Atlantic and Pacific entrances to the canal is arranged with the object of affording sufficient wharves and piers to meet all requirements when the canal is opened, and at the same time to permit of extension in case future needs so require. In addition to wharf space for vessels, the general plan provides the necessary facilities for docking and repairing all classes of vessels and for furnishing them with fuel, fresh water, and supplies of all kinds. As these facilities may be required for military purposes as well as commercial, all general plans were submitted to the Navy Department for its views, which have been followed in the final designs.

The main coaling plant at the Atlantic end of the canal will be located on the north end of the island opposite Dock No. 11, at Cristobal, with railroad connection across the French canal. It will be capable of handling and storing 200,000 tons of coal, with a possible increase of 50 per cent; 100,000 tons will be in subaqueous storage. The coaling plant at the Pacific terminus will be located at Balboa, adjacent to the site of the dry dock, and will be capable of handling and storing 100,000 tons of coal, with a possible increase of 50 per cent; subaqueous storage will be provided for 50,000 tons. Arrangements are made for supplying fuel oil, and four tanks of 40,000 barrels capacity each are under advertisement, which will give an initial storage capacity of 80,000 barrels at each terminus.

The piers or docks on the Atlantic side are to be protected against storms by a mole or breakwater extending out in prolongation of the line separating the Zone from Colon. They are to be 1,000 feet in length, 209 feet in width, and 300 feet apart. At present the Panama Railroad Co., to meet its own requirements, is engaged in building one of the piers, with a slip on either side, and a 1,000-foot wharf, together with the necessary length of mole or breakwater to afford protection. On the Pacific side the piers for commercial use will be placed at right angles to the axis of the canal, with the ends of the piers 2,650 feet from the center of the 500-foot canal channel. The piers will be 1,000 feet long and 200 feet wide, with 300-foot slips between the piers. The construction of one pier is to be undertaken. The superstructure of the commercial piers and wharves will be one-story steel sheds, with a clear height of 25 feet. The sheds, of fire-proof construction, will cover the entire pier except for a space of about 18 feet along each side and the outer ends. A track will extend along each edge of the piers at floor level, and two tracks will run through the center of the pier sheds, so depressed as to bring the car floor level with the floors of the sheds. Much study was given to providing for the economical handling and storing of freight at the ter-

minals, but the best type of cargo-handling appliances can not be determined at this time, as the amount of freight that will be moved from ship to ship at the terminals or will require storage is at present unknown.

The plans provide for one dry dock capable of accommodating any vessel that can pass through the canal locks. It will have a usable length of 1,000 feet, an entrance width of 110 feet, and a depth over the keel blocks of 35 feet at mean sea level. The dock will be built in the rock, which will be lined with concrete after it has been excavated. The borings indicate that the rock is strong, solid, and well suited for such construction. In lieu of the marine railway at first contemplated for smaller classes of vessels, an auxiliary dry dock will be provided, and a suitable foundation on similar rock has been found for it. This dock will have a usable length of 350 feet, a width at entrance of 71 feet, and a depth over the keel blocks of $13\frac{1}{2}$ feet at mean tide. On the Atlantic side the present dry dock at Cristobal, which has a usable length of 300 feet and a width at entrance of 50 feet, with a depth over the sill of 13 feet at mean sea level, will be retained.

Plans for the various shops, foundries, storehouses, and subsidiary buildings have been approved, and specifications are prepared for furnishing the material, as it is desirable to have the erection completed and the machine shops moved from Gorgona by July 1, 1913. The machines now in use will be installed in the new shops, and they will be electrically driven, both individual and group drives being used. The floor area of the buildings in connection with the shops aggregates 491,380 square feet. Until further requirements are more definitely developed, the shop facilities for emergency repairs will be retained in the vicinity of the dry dock at Cristobal.

For the expeditious and convenient handling of lock gate leaves, as well as for commercial and other canal needs and for general wrecking purposes, it will be necessary to provide a floating crane of the largest practicable capacity at each terminus of the canal. An investigation is now under way to determine the best manner in which these requirements can be filled.

For handling vessels of the largest size, harbor tugs of high power will be required and must be secured, as the tugs now owned by the commission will not be satisfactory or economical for that service. It is intended to provide two large harbor tugs at each end for this purpose.

It may be reasonably expected that a large quantity of coal will have to be furnished to shipping in barges or lighters, so that the canal must be equipped with a sufficient number, not only for this service but also for supplying fuel oil and fresh water. The Navy Department has recommended that provisions be made for sufficient

lighters to give a capacity of 16,000 tons of coal for the Atlantic terminus and 8,000 tons for the Pacific end. This will be done.

During the year the locations of the permanent administration building and canal headquarters and the permanent settlements for employees have been determined. The permanent administration building will be on a knoll west of Ancon quarry, and quarters for employees attached thereto will be erected in the general area adjacent to and northeast of this building. Employees connected with the shops, docks, and other terminal facilities will be housed in quarters erected in the area surrounding the slope of Sosa Hill and on the fill adjoining the Ancon-Balboa highway. There will be a permanent settlement at Pedro Miguel for employees of the Pacific locks and one at Gatun for employees of the Atlantic locks. The settlement at Cristobal will be maintained and also the one at Ancon.

During the year a number of applications have been received from individuals and companies for leases of land in the vicinity of the Atlantic and Pacific terminals for various purposes connected with the operation of the canal. The question is now being considered with a view to making recommendations in the near future.

Three first-class meteorological stations at Ancon, Culebra, and Cristobal were continued during the year, each with a full complement of instruments and in charge of a skilled observer. There were two second-class stations at Gatun and Pedro Miguel, at which wind velocity, temperature, and rainfall were recorded. Twenty-six rainfall stations were in operation, 15 of which were equipped with standard and 11 with automatic rain gauges. Evaporation stations were in operation at Ancon, Rio Grande Reservoir, Gatun Lake, Brazos Brook Reservoir, and Colon. Two seismograph stations were in operation, one at Ancon and the other on Guarapo Island, near Gatun. Duplicate automatic tide registers are located on Dock No. 1 at Colon and two on the Panama Railroad Dock at Balboa. Gauging stations were maintained throughout the year, one on the Chagres River at Gatun, one at Gamboa, and one at Alhajuela. Automatic water-stage registers were put in operation above and below the spillway at Gatun and on the Chagres River at Bohio, Gamboa, Alhajuela, and Vigia. The automatic registers on the Trinidad and Pedro Miguel Rivers continued in operation throughout the year at the old locations.

From July 1, 1911, to July 1, 1912, the minimum dry season and total flow for 12 consecutive months for years of record occurred. The previous minimum dry-season flow occurred during the calendar year 1908. The total flow for the calendar year 1911 was the minimum flow for calendar years of record since 1905, and new low-water records were established at Alhajuela and Gamboa. At Alhajuela the minimum was 91 feet on April 20, 1912, and at Gam-

boa 43.5 feet on May 7 and 8, 1912. The previous low-water records were 91.86 at Alhajuela on April 26, 1905, and 44.40 at Gamboa on April 4, 1911. According to the discharge measurements at Gamboa, the heaviest freshet of the year occurred on August 21, 1911, when there was a rise at that point of 11.4 feet and the discharge was 35,120 cubic feet per second. The minimum flow at Gamboa during the year was on April 10 and 11, 1912, and the discharge was 250 cubic feet per second. Backwater from Lake Gatun interfered with gauging work on the Trinidad River, at Bohio, and on the Gatun River.

The temperature for the calendar year 1911 was generally above normal. July was the warmest month in Ancon and Culebra and December at Colon. The highest temperature recorded during the year was 95° F. at Ancon on October 16, and the lowest 65° F. at Culebra on March 27.

The rainfall in the Canal Zone during 1911 was below normal at all stations, being the lightest of record at Gamboa, Bohio, and several of the stations for which only a few years' records are available. The deficiencies ranged from 10 per cent at Balboa to 41 per cent at Bohio. The dry-season rainfall amounted to 12 per cent of the annual total in the Pacific section and 8 per cent and 9 per cent, respectively, in the central and Atlantic sections. The average rainfall for the calendar year 1911 was 67.20 inches in the Pacific section, 79.10 inches in the central section, and 116.45 inches in the Atlantic section. The number of rainy days in the Pacific section was 172, in the central section 214, and in the Atlantic section 265. The heaviest precipitation of the year occurred at Porto Bello on November 29, when during the storm 7.60 inches of rain fell in 12 hours, the maximum fall for 5 minutes being approximately 2.48 inches.

There was a moderate excess of wind movement at the various stations during 1911. The prevailing direction was from the northwest at Ancon and Culebra and from the north at Colon. The relative humidity was generally below normal during the year 1911 and the first half of 1912; the mean for 1911 was 81 per cent at Ancon and 84 per cent at Culebra and Colon.

Slight seismic disturbances were of frequent occurrence during the year, but few were of sufficient intensity to be sensibly felt in the Canal Zone.

A stadia survey was made to locate the ridge line between the upper Gatun River and the Atlantic Ocean, and 19 miles of line were run between Mount Bruja and Santa Rita Mountain. A stadia survey was made of the Atlantic coast line in the vicinity of Margarita Island, near Colon, and a triangulation station was established on the island. The Majagual and Escondido Rivers were run up to

the limits of tidewater. Several islands and inlets not heretofore shown on the maps were located.

There were no marked changes in the conduct of the mechanical work on the Isthmus during the past year. Constant efforts were made to reduce the cost of repairs to equipment and a marked reduction was made in car repairs. All the equipment has been growing older, and general repairs were required to a greater extent during the past fiscal year than during any previous one. This is especially true of locomotives, largely on account of stay bolts breaking, defective flues, and wearing out of tires.

The principal shops are located at Gorgona, and the policy of concentrating manufacturing work and repairs to rolling equipment at these shops has been continued. With the construction work drawing to a close, the general policy of gradually reducing the amount of repair parts and other material carried in the storehouses caused the mechanical division to handle more and more manufacturing work on short notice, and also resulted in the installation of a Tropenas 2-ton converter, blower, sand grinder, and all necessary apparatus for the manufacture of steel castings. Two additional pipe cutting and threading machines—one 8-inch and one 12-inch—were installed in the main shops, and in the planing mill the French horizontal compound engine, which formerly operated these shops, was replaced by a stationary engine removed from the Lirio planing mill and supplemented with a 50-horsepower motor.

Engine houses and repair shops were operated at Pedro Miguel, Gatun, Las Cascadas, Gamboa, and Gold Hill. The removal of material from the top of the slides on the Gold Hill side of the cut required the establishment of an engine house, and a temporary repair shop and storehouse, made of two old box cars, were installed, with the necessary storage and cleaning tracks. The Gatun machine and repair shop was transferred to the mechanical division, and on July 1, 1912, the Empire shops for the repair of steam shovels were also transferred to the same division.

The operation and maintenance of the air-compressor plants at Las Cascadas, Empire, Rio Grande, and Balboa are also under the mechanical division, as well as the operation and maintenance of the electric power and lighting plants at Cristobal, Gorgona, Empire, and Balboa. The output of all air-compressor plants operated during the year was 8,795,157,453 cubic feet of free air at 70° F., which was compressed and distributed at 100 pounds pressure, at an average cost for the year of \$0.0312 per thousand cubic feet. The increased construction work on the Pacific division and the decrease of work on the north end of the Atlantic division increased the air consumption at Pedro Miguel and Miraflores to such an extent as to necessitate the removal from the Las Cascadas plant and installation in the

Aguadulce pumping plant of the Pacific division of two 2,200-foot Ingersoll-Rand compressors, with necessary boilers and pumps. The mechanical division's electric plants totaled an output of 4,966,953 kilowatt hours, which, with 2,279,151 kilowatt hours furnished by the construction divisions to the mechanical division, makes a total of 7,246,104 kilowatt hours distributed and billed by this division.

The total appropriations made by Congress up to June 30, 1912, amounted to \$293,561,468.58. By act approved August 24, 1912, additional appropriations were made for the fiscal year 1913 amounting to \$28,980,000, exclusive of fortifications. On June 30, 1912, \$259,653,236.74, or about 69 per cent of the total estimated cost, had been charged into the work. Of this amount, \$34,183,183.48 were expended during the fiscal year 1911, or about 9 per cent of the total estimated cost of the canal. The difference between the appropriations and the classified expenditures to June 30, 1912, amounting to \$33,908,231.84, represents such items as receipts returned to the Treasury of the United States, unexpended balances of appropriations, unexpended material and supplies in storehouses, and other items that will not be prorated to construction work until the construction is completed; buildings of all descriptions, roads, sewers, and water supplies. Of the total classified expenditures to June 30, 1912, \$32,547,720.75, or about 12½ per cent, were for plant and equipment for construction and for four steamships; of this amount, \$1,254,697.70 were expended during the fiscal year 1912.

For further details, attention is invited to Appendices F and G.

CONSTRUCTION OF THE NEW PANAMA RAILROAD.

The construction of the new or relocated line of the Panama Railroad was continued by the engineering department of the Panama Railroad Co. during the year and was in charge of Lieut. Frederick Mears, United States Army, as chief engineer of the Panama Railroad.

At the beginning of the year construction work was confined to the stretch of road from Gatun to Gamboa—the Gatun Valley section—and consisted in completing the embankments across the Quebrancha, Brazos, and Baja bottoms, which have been under construction since 1910. The amount of material reported as necessary at the beginning of the fiscal year for their completion, 850,000 cubic yards, was exceeded and, though they were practically completed on January 1, 1912, two steam shovels were at work during the following month and a half furnishing material for riprapping the slopes. The largest embankment on this section of the railroad is 4,800 feet long across the Brazos bottom. The rock in this valley is from 150 to 200 feet below the surface of the ground, which is of fairly good clay from

20 to 30 feet thick, but between this and the rock the material is very soft. The embankment, which is 60.70 feet high, was given side slopes of 1 on 2 with the hope that this would spread the foundation sufficiently to enable the layer of clay to support it without disturbing the soft strata. Just before the full height was reached, however, the pressure became too great and the soft material moved out, upheaving the natural ground beyond the toes of the slopes. When this occurred the base was widened so as to secure a slope of about 1 on 3 before any weight was added to the upper level, after which the embankment was completed to grade. Trouble with settlements was encountered in the fills over the Quebrancha and Baja bottoms, where it was necessary to spread the base so as to secure a slope of 1 on 4; these fills were 72.70 and 68.70 feet, respectively, above the natural surface of the ground. In the 3 miles covered by these bottoms, 4,736,072 cubic yards of material were placed, or an average of 1,578,690 cubic yards per mile, all necessary to secure a permanent roadbed above the proposed lake level.

Laying the remainder of the permanent track was undertaken in December, 1911, and completed as far as practicable by February 15, 1912. The track is of 90-pound open hearth steel, 100 per cent splice bars, and either creosoted or hardwood crossties fitted with "Economy" tie-plates and screw spikes. The track was ballasted with gravel obtained from the deposits in the Chagres River.

This section was formally turned over to the Panama Railroad Co. on February 15, 1912, on which date the operation of the road was transferred from the old to the new line. Trains now operate east of the canal as far as the north end of Culebra Cut, where they switch back across the canal on a construction dike to the old main line, following it north to Gorgona, thence south over the old route to Panama. The operation over the new roadbed was attended with no difficulties, except that in some cases small slides occurred along the slopes of the embankments. The work of riprapping the submerged embankments was continued and the weight of rock has sometimes caused the sides of the fill to slide, but has not interrupted operation.

The slides on the east side of Culebra Cut and the necessity of maintaining through communication caused the construction of a high line around Gold Hill and the abandonment of the original plan of carrying the railroad on the 95-foot berm through Culebra Cut. It was hoped that eventually the high line might be abandoned in favor of the 95-foot berm, but all thought of this has been given up on account of the excessive cost of rebuilding this berm throughout the cut. The Gold Hill line joins Gamboa bridge on the north with Pedro Miguel on the south, and is $9\frac{3}{4}$ miles long. The summit is near

the La Pita divide at elevation 271 feet above mean sea level, and the continental divide is crossed opposite Culebra at an elevation of 241 feet above mean sea level. This section of the road was well under construction at the beginning of the fiscal year, and the work progressed to completion in the early part of 1912. Some difficulty was encountered along the Pedro Miguel River on account of slides. The laying of the permanent track was begun in May and the line was completed and formally turned over to the Panama Railroad Co. on May 25, 1912.

The construction of the telephone and telegraph line was continued during the year and completed on June 30, 1912. A new frame station building and section house were erected at the town site of Monto Lirio on the Gatun River, and a reenforced concrete water station constructed at Frijoles. Work of dismantling the old bridge at Barbacoas, consisting of three girder spans, was undertaken as soon as the original Panama Railroad was abandoned on February 15, 1912. The bridge was transferred to Monte Lirio, where it is to be used for carrying the relocated line over the Gatun River. The two shore spans were set in place at the new site and the center span is to be converted into a balanced lift span, so that steamers can have access to the upper arm of Gatun Lake.

During the year 3,209,021 cubic yards of grading were completed at an average cost of \$0.345027 per cubic yard, including the cost of clearing 28.7 acres, and 123,463 lineal feet of permanent track laid at a cost of \$2.9863 per lineal foot; 1,820.2 cubic yards of concrete were placed in bridge culverts.

For further details concerning this work, attention is invited to Appendix H.

FORTIFICATIONS.

The act approved March 4, 1911, appropriated \$2,000,000 for the construction of gun and mortar batteries for the defense of the canal against naval attack. The actual execution of the work was assigned to the commission, and the constructions are to conform to plans furnished by higher authority.

Work was commenced on August 7, 1911, under a provisional organization which continued until January 1, 1912, when the work was consolidated and placed in charge of Lieut. George R. Goethals, United States Army, reporting to the chief engineer.

During the year 408,392 cubic yards of excavation, at a cost of \$0.571, were done, 5,159 cubic yards of concrete, at a cost of \$9.055 per cubic yard, were laid, and a channel excavated to one of the islands by dredging 32,150 cubic yards, at a cost of \$0.377 per cubic yard.

COST KEEPING.

The methods of cost keeping adopted on January 1, 1910, were continued throughout the year. In addition to those reported a year ago, cost accounts were prepared and kept for aids to navigation, terminal facilities at Balboa, fortifications, and installation of the lock-operating machinery. Supervision of cost data for the construction of the docks at Cristobal and the New Washington Hotel at Colon was added to the duties of the office; as these pieces of work are in charge of the Panama Railroad, their costs are not included in this report. The costs are made up of the labor engaged in and the material applied to the work, an arbitrary to absorb the cost of the plant and a proper proportion of the division overhead charges. As the plant was designed by the division engineers and, within limits, they are responsible for the organization carrying on the work, the costs are to a certain extent comparable where the character of the work is similar. The general expenses of the commission are prorated to different parts of the work and must be added to the division costs in order to determine the total cost. As the division engineers do not necessarily have control over the items which make up these general expenses, the costs reported are the division costs except where noted to the contrary. The cost-keeping accountant, Mr. Ad. Faure, reports directly to the chief engineer. His duties consist in supervising and verifying the statements of costs furnished by the division engineers, establishing accounts for new work, and preparing statistical data.

In the distribution of general expenses the central division continues to carry the larger proportion, due to the fact that prior to 1907 but little work was done except in this division, so that all the overhead charges were properly added to it.

Excavation in the prism by steam shovels was cheapest in the central division, averaging \$0.5101; in the Atlantic division a lower cost is shown than during the previous year—\$0.5952 against \$0.6010—while in the Pacific division it is higher—\$0.7527 against \$0.6960—and also greater than in the Atlantic division. In the preparation of the foundations, the costs are higher in the Atlantic division than a year ago and lower in the Pacific division, while those of the Atlantic division are higher than in the Pacific division.

In dredging the costs were higher than for the previous year, and for work in the channels the Pacific division shows lower than the Atlantic division; the Pacific division dredging does not include any arbitrary for plant, the total cost of which was absorbed prior to the fiscal year, but on this side increase in depth is attended with additional expense because of the great tidal variations.

There was a total of 1,443,570 cubic yards of masonry laid in the locks and spillways during the year, as against 1,741,908 cubic yards

during the previous year. The unit costs for the masonry were: Gatun Locks, \$7.7552; Gatun spillway, \$7.0988; Pedro Miguel Locks, \$6.4640; Miraflores Locks, \$4.7675. With a decrease in quantity laid of 512,315 cubic yards in the Gatun Locks, the cost of plain concrete last year shows an increase of \$0.5398 as compared with the previous year. At Pedro Miguel, with a decrease in the amount laid of 363,609 cubic yards, there was an increase in cost of \$1.0143, due to forms, placing, mixing, and plant arbitrary, the construction plant having been removed to Miraflores, with exception of two berm cranes, which were operated until December 12, 1911, and February 7, 1912, respectively. With an increase in quantity of 456,163 cubic yards, the cost of plain concrete at Miraflores shows a decrease of \$0.0959. The labor costs for the year per cubic yard of plain concrete at the various locks and spillways show lowest at Miraflores, \$0.8394; next, Gatun Locks, \$1.3840; Pedro Miguel Locks, \$1.4733; and Gatun spillway, \$1.5425.

The difference between the costs in the Atlantic and Pacific divisions is mainly in the cost of cement, sand, and stone. While the cement for the Atlantic division is now handled in bags, it must pass through the cement shed, while the bulk of the cement in the Pacific division passes directly from the cars to the work. In the production of stone the cost in the storage bins at Gatun was \$2.4952, while in the storage pile for the locks on the Pacific side it was \$0.7996 per cubic yard, a difference of \$1.6956 per cubic yard. If there be deducted from this difference the extra expense attached to the Porto Bello stone represented by the difference between the costs of towing and unloading and that of transportation by rail, amounting to \$0.7365 per cubic yard, and the difference in plant arbitraries, amounting to \$0.4336, the net difference in labor cost in favor of Ancon quarry is \$0.5255 per cubic yard. Sand from Nombre de Dios in the stock piles in the Atlantic division averaged \$2.2414 as against sand in the stock piles of the Pacific division at \$0.7025, or an excess of \$1.5389 per cubic yard in the cost of Nombre de Dios sand over that from Chamé. Chamé sand delivered in the stock pile at Gatun cost \$1.7079, including \$0.7890 for unabsorbed plant charge at Nombre de Dios. The sand secured from the Chagres River between May 15 and June 30 cost \$1.2850 delivered in the stock pile, including \$0.7671 for plant.

The cost of concrete piling at Gatun was \$0.0679 less during the year than in 1911, while the cost in place was \$0.7088 less. The total amount driven was 83,670 lineal feet, at a cost of \$1.5719 per lineal foot; in addition, 51,450 lineal feet of wooden piles were driven, at a cost of \$0.6516 per lineal foot. On this basis had wooden piling only been used for the south approach pier a saving of \$77,001.50 would have resulted. In the Pacific division 6,580 lineal feet of

wooden piling were driven for the foundations of the northeast wing wall, at a cost of \$2.3200 per lineal foot.

In connection with division costs it is to be noted that the amounts paid for salaries of clerks and supervisory forces in the three construction divisions were less in the central and Pacific divisions during 1912 than those paid during the fiscal year 1911, while in the Atlantic division the percentage was higher. These percentages were as follows: Atlantic division, 26.09; central division, 17.39; Pacific division, 18.94.

For further details concerning the costs of the various parts of the work and the performance of the different plants, attention is invited to Appendix I.

QUARTERMASTER'S DEPARTMENT.

The quartermaster's department is charged with the recruitment of labor; care, furnishing, and assignment of quarters; distributing fuel, commissary supplies, and distilled water; construction and repair of all buildings; requisitioning for supplies of all kinds, together with the receipt and distribution of them on arrival; cutting of grass and disposal of night soil and garbage as prescribed by the sanitary department; and the auditing of all property returns. The department is in charge of Col. C. A. Devol, United States Army, as chief quartermaster.

There was no change in the organization of the department during the year.

The number of employees of the commission and Panama Railroad on the Isthmus fluctuated during the year; in March, 1910, the highest recorded force was reached, aggregating 38,676; on June 30, 1911, the force totaled 32,690 men, and on June 30, 1912, 34,957 men were employed by the two interests. While there was a decrease as between June 30, 1911, and June 30, 1912, of approximately 2,900 men in the Atlantic division and on the relocation of the Panama Railroad, this has been more than offset by increases because of the construction of the docks at Cristobal under the Panama Railroad, the terminals at Balboa under the Pacific division, the work of the first division of the chief engineer's office, and the fortifications. Immigration to the Isthmus continued to decrease, the excess of arrivals over departures for the year amounting to 3,510. At the beginning of the fiscal year 941 laborers were recruited in Barbados and the small islands adjacent thereto, in order to meet a demand for unskilled labor, which could not be recruited on the Isthmus from the unemployed living in the brush. The supply of and demand for labor was about balanced at the end of the year. During the last three months of the year 1,339 laborers were taken over by the United Fruit Co. for work in Guatemala.

The average number of American employees on the rolls of the commission during the year was 4,264, on the rolls of the Panama Railroad 837, or a total of 5,101. During the same period there were 2,123 separations from the service of the commission, 559 persons employed in the United States and 1,286 employed on the Isthmus, indicating that more than 49 per cent of the force was changed.

There were 22 new buildings constructed during the year, at a total cost of \$26,000; of these the fire station at Cristobal, the caretaker's residence at Brazos Brook reservoir, and a type 27 at Toro Point cost \$21,000; the remaining 19 were small, costing \$5,000. The fire station and the caretaker's house are permanent structures of concrete. Eighteen additions to existing buildings were made, at a cost of \$71,000; of this amount \$63,000 were expended for alterations and additions to the Hotel Tivoli. Thirty-six buildings were taken down in sections and moved to new locations, at a cost of \$58,000. Fifteen buildings were demolished, material moved to other points and used in construction of 13 buildings, costing \$26,790.30. Of these 51 buildings, 14 were removed from Culebra on account of slides and 25 from Tabernilla and San Pablo on account of the flooding of the lake area. The removal and reerection of American buildings still good, but useless in their old locations, accounts for the small amount of new construction. The purchase from the Pacific Mail Steamship Co. of their undivided half interest in the islands in the Pacific brought with it 22 buildings, which were utilized for quarters in connection with fortifications. Of old French buildings, 149 were sold, realizing \$8,000, and 131 were demolished, a loss of 280 buildings. Of the 2,148 buildings turned over by the French in 1904 but 850 remain. The laborers' camp at White House and other buildings in the Las Cascadas district were altered and repaired as quarters for the Tenth Infantry, United States Army. These alterations and repairs were made at an expense of \$50,000, payable from the appropriation for barracks and quarters, United States Army.

An analysis of the census of occupants of quarters shows a decrease of 300 in the number of Americans and an increase of 700 in the number of West Indians in quarters. The number of Europeans remains the same. Of the Americans, 210 are employees of the McClintic-Marshall Construction Co. This census also shows that 48 per cent of the married men and 20 per cent of the bachelors were hired prior to 1908. There has been no diminution in the demand for married quarters, the number of applications on file as of June 30 being 697, or 54 more than a year before.

The policy of reducing the stock concentrated in the storehouses, so as to leave, when the canal is completed, the smallest accumulation that is consistent with the continuous and efficient progress of the

work and wise economy, has been continued. Relatively few annual contracts were made during the spring, as on certain classes of stock prospective requirements are so small that orders can be placed when needed. The quantity and value of supplies received from the United States were larger than during any previous year of the canal work. There were received 504,004 tons of material, with a value of \$10,517,260.99. This does not include the piling nor material for the McClintic-Marshall Construction Co. There was a decrease in the cement receipts, but an increase in the amount of piling and of over 4,000,000 feet b. m. in lumber. A large amount of material was recovered from the work and returned to stock. The central and Atlantic divisions and the relocation, part of whose work was completed, turned in material to the value of \$680,000. Clean-ups of repair shops were made, and repair parts, fittings, and miscellaneous material were turned in in large quantities. The total amount of reduction in stock, including material turned in, was \$1,652,969.34.

So far, but little of the commission's plant has been retired. Material to the value of \$193,313.34 was surveyed and turned into the storehouse for obsolete material during the year, the amount remaining on hand at price-book prices being \$369,000. The quantity was such that additional facilities had to be provided and an addition to the storehouse for obsolete material was constructed. Property to the value of \$21,704.65 was reissued and \$10,708.94 was disposed of by local sales from the storehouse for obsolete material. Much of the obsolete material and equipment was advertised for sale in February; the bids on 18 classes were rejected and awards made on 8 classes for the sum of \$20,858.

On September 26, 1911, a contract was entered into for the sale of all French scrap on the Isthmus as it lies for a consideration of \$215,000. Approximately 10,000 tons have been collected for shipment. About 4,603 tons of American scrap were collected at the Empire and Gorgona shops and stored at Mount Hope. Of this amount 1,892 tons were shipped and sold in New York at an average price of \$10.35 per ton, the net price realized being about \$5 per ton. Sales of scrap screening, rope, rubber, hose, and rubber belting continued throughout the year. A contract was entered into October 12, 1911, for delivery at New York of the screening at \$8.25 per hundredweight, rope at \$2.18 per hundredweight, rubber at \$2.10 per hundredweight, and hose at \$2.50 per hundredweight.

The work done for the sanitary department, consisting of grass and brush cutting, disposal of night soil and garbage, continued as heretofore. In accordance with the recommendations of a board, the grass-cutting areas in the various districts were plotted and measured and regulations compiled for sanitary inspectors and district quar-

termasters with reference to the method of handling work performed by the quartermaster's department for the department of sanitation. Less grass cutting has been done since January 9, 1912, as objection was raised by the sanitary department that keeping the grass cut close around quarters was not necessary except for æsthetic reasons, and that it could be allowed to grow a foot high, so far as sanitary purposes are concerned. As there are no funds available except for sanitary grass cutting, no work of this kind is done under existing regulations except on requests by the sanitary department. The cost of the sanitary work done by the quartermaster's department amounted to \$251,768.07.

The regular delivery work done by the quartermaster's department was continued, and, in addition, delivery service was furnished to the Tenth Infantry. Horse mowing machines were introduced into all districts, which necessitates the use of more teams by the sanitary department. Twenty-four horses and mules were condemned and destroyed, 10 condemned and sold, 6 were killed, and 8 died—a total of 48. No animals have been purchased for over three years, and the service of those now in the corrals averages over six years.

The quartermaster's department attends to all purchases on the Isthmus, and the amount expended aggregated \$2,639,416.09, of which \$1,540,700.65 were for the purchase of coal from the Panama Railroad Co., \$978,055.26 for the purchase of crude oil from the Union Oil Co., and \$96,176.24 for miscellaneous purchases from the Panama Railroad Co., leaving \$24,035.94 for the purchase of miscellaneous supplies from local merchants. The balance was used for postage stamps.

For further information concerning the operations of this department, attention is invited to Appendix J.

SUBSISTENCE DEPARTMENT.

The subsistence department is charged with the operation of the Isthmian Canal Commission hotels, messes, and kitchens, and is in charge of Lieut. Col. Eugene T. Wilson, United States Army, as subsistence officer.

On June 30, 1912, this department was operating 19 line hotels, 3 night restaurants, 18 European laborers' messes, and 18 common laborers' kitchens—an increase of 2 messes and 4 kitchens over last year. The hotel and kitchen at Nombre de Dios and the hotel at Tabernilla were closed because of completion of the work at these points. One of the two messes at Bas Obispo was also closed. Hotels, messes, and kitchens were opened at Naos Island and Margarita Island, a mess and kitchen at Cerro, and kitchens at Rio Grande and Paraiso. The revenue from the line hotels, restaurants, messes, and kitchens was \$1,263,869.81, an increase of \$9,607.41 over

the previous year. The total cost of operations was \$1,226,352.16, an increase of \$4,882.90. The profit was \$37,517.65, an increase of \$4,724.51 over the previous year. The total number of meals served in the line hotels was 2,075,335, 6.38 per cent less than during the previous year; the total number of rations served in European laborers' messes was 1,108,175, 5.09 per cent more than during the year previous; the total number of rations served in common laborers' kitchens was 584,457, 31.49 per cent more than during the previous year. The expenditures in salaries and wages for line hotels, restaurants, messes, and kitchens was \$162,006.78, a saving of \$10,022.74, as compared with the previous fiscal year. As the result of the year's operations, the line hotels and restaurants showed a loss of \$12,085.37, the European laborers' messes showed a profit of \$38,455.78, and the common laborers' kitchens showed a profit of \$11,147.24.

The accommodations of the Hotel Tivoli were increased during the year by building to it a new wing, thereby increasing the number of rooms opening on private baths from 28 to 90. New furniture and other equipment to the value of approximately \$10,000 were purchased, the greater part of this equipment being for the new rooms. The hotel was operated at a profit of \$53,652.36.

For further particulars concerning the operations of the subsistence department, attention is invited to Appendix K.

EXAMINATION OF ACCOUNTS AND DISBURSEMENTS.

EXAMINATION OF ACCOUNTS.

The duties of the examiner of accounts were outlined in detail in the annual report of 1909 and have continued with but little change during the year just ended. The department was in charge of Mr. H. A. A. Smith.

The system of bookkeeping by which a record is kept of classified expenditures for the construction of the canal was extended to include accounts for the department of law, terminal facilities at Cristobal and Balboa, lighting and buoying the canal, inspection of lock gates, installation of lock machinery, emergency dams, and the fortifications, with their usual detailed distribution. Since the establishment of the method of absorbing plant charges, begun July 1, 1909, a total of \$25,226,779.74 has been charged to construction costs up to June 30, 1912, leaving a balance of \$3,590,949.49 still to be absorbed. The classification of accounts recommended by the Commission on Economy and Efficiency for all Government departments would necessitate a radical departure from that now in use, and, because of the small remaining portion of the work of construction and the confusion that a change at this time would create, it

was recommended that the new system be not put in force on the Isthmus until after the accounting method has been adopted for the operation and maintenance of the canal. This was approved by the President of the United States.

The financial accounts of employees making collections or reporting charges for collections were carefully audited. Bills against employees and outside parties for charges due the commission on account of services and materials increased during the year, the monthly average being 490.

The required administrative examination of the disbursing officer's accounts was made monthly. A careful check was made of unpaid salaries and wages representing amounts earned by employees, but for various reasons not collected. The balance, which has been accumulating since the beginning of the work, amounted to \$238,634.02 on June 30, 1912.

Under the revised agreement with the Republic of Panama for the construction and maintenance of waterworks, sewers, and pavements within the cities of Panama and Colon and for the reimbursement of such expenditures to the United States, there were expended \$1,432,110.68 in the city of Panama and \$1,297,566.04 in the city of Colon, a total of \$2,729,676.72, while during the same period \$757,025.76 were reimbursed, of which \$219,163.92 was for interest on outlay, leaving a balance due the United States of \$2,191,814.88. Included in the reimbursed amount is \$27,830.51, representing the value of water used by the Isthmian Canal Commission in the two cities.

There are 49 bonded employees engaged in issuing coupon books and meal tickets. During the year 593,900 coupon books and over 1,700,000 meal tickets were issued and proper collections made. On June 1, 1912, the method of selling commissary books for cash by the commissary department of the Panama Railroad Co. was installed at several points, in addition to the existing practice of issuing books for payment by pay-roll deduction. This practice reduced to some extent the work of the issuing clerks and increased the volume of business in the commissaries during the early and latter parts of the month on the days when the issue of commissary books was prohibited. The purchase and the issue of commissary books to issuing clerks were transferred to the Panama Railroad Co. on July 1, 1912. During the year \$3,123,220.96 were paid the railroad company on account of commissary coupon books issued and collected by the commission.

The accounts of all bonded employees charged with the collection of funds were inspected at frequent and irregular periods, as in the past. A more complete and detailed checking of the accounts of post offices, hospitals, and Hotel Tivoli was instituted during the year,

made necessary by the great and increasing volume of business and by the installation of the postal savings system. Effective November 1, 1909, the Illinois Surety Co. executed a schedule bond covering employees of the Isthmian Canal Commission and the Canal Zone Government who were required to give bond under the regulations, with the understanding that the bond was to run for a period of three years. To avoid the difficulties incident to a change in surety companies just as the canal work is being completed, arrangements were made with the surety company to continue the bond in effect from year to year from July 1, 1912, at the rate heretofore paid—\$3 per thousand.

The number of claims audited and vouchers prepared during the year totaled 3,440, involving disbursements to the amount of \$10,440,047.25, of which over \$9,000,000 represents payments to the Panama Railroad Co. The increase in number of claims is largely due to payments to landowners and others in the region to be occupied by Gatun Lake. Unsettled claims at the end of the year amounted to \$114,176.99, of which \$73,107.05 included several large claims for land purchased but not yet completed for payment.

To the largest division of the office is assigned the duty of auditing the pay rolls of the commission and keeping up the personnel file of gold employees. There are 121 pay rolls each month, carrying in the aggregate over 36,000 payments involving approximate monthly disbursements of \$1,500,000. They include not only the amount paid to each employee, but deductions made on account of amounts due the United States or the Panama Railroad Co. To this division is also assigned the duty of examining recommendations for meritorious sick leave, which during the year totaled 5,141 cases and resulted in payments amounting to \$55,838.25.

In the time-inspection division the number of districts has been reduced to three, the senior inspectors being located at Ancon, Empire, and Gatun, and a reduction in the force of inspectors was made from 46 to 42 without detriment to the work.

Verification of the cash balance in the hands of the disbursing officer was made by witnessing the transfers of cash and cash values between the disbursing officer and his assistant on September 1 and November 1, 1911, and a complete check, including a count of all cash on hand, was made on December 15, 1911.

The examiner of accounts handles claims that arise under the employers' liability act. In accordance with section 5 of the act of March 4, 1911, claims totaling 1,849 were filed during the year on account of injuries received in the course of employment and 50 claims on account of deaths—a total of 1,899. Of these, 1,410 injury claims and 31 claims on account of death were allowed; 167 injury claims and 18 death claims were disapproved; 174 injury claims were

for less than 15 days, hence were settled on pay rolls, and at the close of the year there were 98 injury and 1 death claims under investigation. The total amount paid out during the year in these claims was \$259,993.14. From the effective date of the act (Aug. 1, 1908) to June 30, 1912, \$691,753.07 were paid to employees for injuries received in the course of employment, including meritorious sick leaves.

A new system of accounting will have to be introduced for the operation and maintenance of the canal, and all accounting on the Isthmus should be under one head. This will include receipts from tolls and from the sale of supplies of all kinds, and disbursements of appropriations by Congress, and of all collections resulting from sales of supplies which the law makes applicable for use; it should include property accountability, as well as collections, disbursements, and auditing of the Panama Railroad on the Isthmus and of the Canal Zone government; also cost keeping. The system should be an up-to-date accounting system and, as the Commission on Economy and Efficiency has established an accounting system for the various departments of the Government, it is believed that this commission is better able to prepare a proper system to meet the wants of the Isthmus than can be done by a board composed of men employed there. It has been recommended that this course be taken with a view to outlining and adopting a system to meet the new conditions at as early a date as practicable.

As already noted, Congress has appropriated \$293,561,468.58 on account of canal work and chargeable against the authorized bond issue. To June 30, 1912, \$5,856,426.77 were collected and returned to the Treasury as "miscellaneous receipts," and this amount should be deducted from the total appropriations in order to determine the net amount available for actual canal purposes. On the other hand, the commission has received benefit from moneys collected which was not expected when the estimates of 1908 were prepared, namely, water rentals paid by the Republic of Panama as a repayment of the amount expended in installing waterworks, sewers, and pavements in the cities of Panama and Colon, and the net receipts from the sale of scrap. To June 30 the commission has had the use of \$625,654.54, received from the water rentals; \$67,492.60, received from the sale of French scrap, and \$98,605.75, received from the sale of American scrap, or a total of \$791,752.89. The total amount available for canal work under its various departments to June 30, 1912, was, therefore, \$288,496,794.70.

The examiner of accounts is also auditor for the Canal Zone government. He receives, examines, and settles all accounts pertaining to the revenues of the Canal Zone government and expenditures therefrom. This includes nearly 600 monthly accounts. The total revenues for the year were \$370,272.81 and the expenditures \$312,-

459.75. The increase in expenditures during the year is principally due to the increase in construction and maintenance of roads and trails and the payments made steamship companies on account of ocean transportation of mails covering the period from 1905 to the present time. There has been a falling off in revenues, due to the abandonment of some of the districts, and as other towns are abandoned the revenues obtained by taxation and rentals will continue to be reduced. During the year the average monthly balance in Washington was \$1,121,707.64 and that on deposit on the Isthmus \$43,625.73, the interest on which amounted to \$20,784.96.

For further particulars, attention is invited to Appendix L.

DISBURSEMENTS.

The work of this department embraces the securing of and disbursing the necessary funds and the accounting for all moneys paid out or collected, as well as the issuance of hotel and commissary books and meal tickets to the various departments of the commission. It is in charge of Mr. E. J. Williams, disbursing officer.

The total amount paid out by the disbursing officer on pay rolls aggregated \$19,407,398.90, in addition to which \$10,465,634.09 were paid out in settlement of public bills and on reimbursement vouchers. The value of hotel books, commissary books, and meal tickets issued totaled \$4,591,510.50.

For further details, attention is invited to Appendix M.

DEPARTMENTS OF CIVIL ADMINISTRATION AND LAW.

CIVIL ADMINISTRATION.

The organization of the department of civil administration remained substantially as described in former annual reports and continued in charge of Mr. Maurice H. Thatcher.

Five ordinances were enacted by the Isthmian Canal Commission and approved by the Secretary of War; the more important were for night quarantine inspection of vessels at the port of Colon; establishing market regulations for the Canal Zone, and instituting a reciprocal license tax upon motor vehicles licensed in the Canal Zone and in the Republic of Panama.

Negotiations carried on with the officials of the Republic of Panama included the following subjects: Charging of fees by Panama consuls in San Francisco for the certification of manifests covering shipments designed for the port of Ancon; adoption of laws and regulations by the Republic of Panama governing the navigation of waters under its jurisdiction uniform with those of the Canal Zone; occupancy of public lands of the Republic by persons forced to vacate lands in the Gatun Lake area; exercise of Canal Zone juris-

diction over Gatun Lake areas lying within the territory of the Republic; operation of the Chinese-exclusion law in the Republic and in the Zone; adjustment of automobile license taxes; interference with United States mails in the city of Colon; transfer by the Panama Railroad Co. to the Panama Government of certain lots in exchange for land situated opposite the Hotel Tivoli; operation of schools for Panaman children by the Government of Panama within the Canal Zone; extradition to the United States of persons charged with carrying on white-slave traffic; extradition from the Canal Zone to Panama of persons charged with crime; deportation of gamblers and other undesirable characters living in Panama and Colon; the operation of saloons in Colon near the Zone line; enforcement of the laws of the Republic prohibiting the recruiting of laborers; attempted exercise of police authority on Zone territory by police officers of the Republic; administration of estates of citizens of Panama who die in the Canal Zone; celebration of marriages in the Republic of Panama by Protestant ministers; customs inspection of baggage at the Panama City railroad station by officials of the Republic; repatriation of alien patients in the Ancon Insane Asylum at the expense of the Panama Government; the construction of buildings, streets, sewers, and other improvements; and the maintenance of proper water service in Colon and Panama. The relations of the commission with the Republic of Panama and with foreign representatives continued satisfactory.

In the last annual report recommendation was made for the depopulation of the Canal Zone, and the reasons on which it was based were stated therein. The question arose as to the number of people that would be affected if such a course were pursued. A census, taken as of June 23, 1908, over four years ago, showed the population to be 50,003, but the accuracy of this was questioned by the sanitary department, which at that time was reporting a population of upward of 70,000. This number had grown to over 90,000, and was so much in excess of the force report that the impression obtained that the number to be moved in case depopulation were resorted to would be upward of 20,000 or 30,000. It was therefore thought advisable to take a new census and to employ for it persons experienced in that line of work. Arrangements were made with the Census Bureau at Washington for transfer to the Isthmus of two of its experts, and the work was placed under the department of civil administration. The census, taken as of February 1, 1912, resulted in the following: Zone population (including the territory of the Canal Zone, the commission settlements at Porto Bello and Nombre de Dios, Colon Beach and Taboga Sanitarium), 62,810. Employees of the commission, Panama Railroad Co., and various canal contractors numbered, as of February 1, 1912, 42,174. Of the 62,810 persons enumer-

ated in the Canal Zone, 1,521 were Colombians and 7,363 were Panamans; of the total 9,157, 4,870 were males. This number represents more closely the probable number that would be affected by the depopulation of the Zone. The total cost of the census was \$12,815.74.

During the year the board of local inspectors issued 34 licenses to pilots; 9 to masters, 4 of which were issued as joint master-pilot licenses; 10 to mates; and 11 to engineers—a total of 64. There were also issued between July 1, 1911, and November 14, 1911, under the provisions of the law then in force, 15 certificates of seaworthiness to launches. Licenses were also issued to 97 chauffeurs under the provisions of the ordinance approved by the Secretary of War on April 26, 1911.

Postage sales for the fiscal year amounted to \$87,694.41, an increase of \$4,800.69 over the previous year. There were 145,633 registered letters and parcels handled, of which 47 per cent was official matter. Money orders to the number of 227,680, having a total value of \$4,915,077.29, were issued, on which fees aggregating \$22,889.90 were collected. Of the money orders issued during the year, orders amounting to \$3,834,251.55 were made payable without and \$1,080,825.74 within the limits of the Canal Zone. Under an Executive order dated September 8, 1911, a postal savings system was established on February 1, 1912, in the post offices of the Canal Zone. At the close of the fiscal year there was on deposit in these postal savings banks a total of \$356,947. There were in the post offices of the Canal Zone on the same date unpaid money orders aggregating \$332,141.60, drawn to the order of the remitter and payable at the office of issue.

During the year 327 vessels entered the port of Ancon, with a total tonnage of 619,422, and the same number of vessels cleared, with a tonnage of 622,023. At Cristobal 284 vessels entered, with a tonnage of 784,156, and 282 vessels cleared, with a tonnage of 775,445.

On June 30, 1912, there were in force 858 leases, of which 575 were for building lots and 258 for agricultural lands—a decrease of 1,383 as compared with the number of leases in force on June 30, 1911. The leases for agricultural lands covered 352 hectares. Rents collected during the year amounted to \$16,033.54. A total of \$122,674.54 was collected from general taxes and licenses; of this amount, \$5,083.71 were for distillation taxes; \$55,200 for licenses for the sale of liquor at retail; \$1,137.83 for license fees from insurance companies doing business in the Canal Zone; and \$2,059 for licenses for motor vehicles.

During the year 60 estates were settled, and on June 30, 1912, there were 98 estates in the course of settlement. The money handled on account of the administration of estates was \$7,306.31.

At the end of the fiscal year the organization of the police force remained the same as it was at the time the last annual report was

written. There were 7,055 arrests made during the year, of which number 6,452 were males and 603 females. Of the total number of persons arrested, 79 per cent were convicted. On June 30, 1912, there were 141 convicts confined in the penitentiary at Culebra, who were kept at work on public roads, and the value of their work, on the basis of 10 cents an hour, was \$28,126.95. The cost of guarding, subsisting, and clothing the convicts was \$35,325.03. A stockade was erected on the Mandingo River for the temporary housing of convicts while building the Empire-Chorrera Road. Slides on the west bank of Culebra Cut made necessary the demolition of the penitentiary buildings at Culebra.

The only changes in the organization of the division of fire protection were a reduction of one in the number of firemen and the employment of a motor engineer. The new concrete fire station at Cristobal, described in the last annual report, was completed and occupied early in January. The small station at Balboa was removed to make room for the construction of the terminals at that point. The Tivoli station was altered to accommodate one of the two new combination automobile fire engines and hose wagons which were purchased during the year. There were 333 alarms of fire responded to, 18 of which were false. Of the 315 fires, 6 were in the city of Panama and 2 in the city of Colon; 196 were in Government property and 21 in property of the Panama Railroad Co. The value of Government and railroad property involved was reported to be \$1,755,685.58. The total loss was estimated at \$4,538.58 for Government property and \$101 for property of the Panama Railroad Co. The largest fire on the Zone totally destroyed two private frame dwellings at Miraflores and caused a loss of \$5,000. The year's fires resulted in 12 injuries from burns; two deaths occurred, one from the explosion of gasoline fumes and the other from an explosion of alcohol.

There was no change in the organization of the division of public works. In the city of Panama 1,985 water connections have been made to date, and on June 30, 1912, 35 applications were pending. The collections of water rents from private consumers for the first three quarters of the year in the city of Panama were \$67,491.75, and bills rendered for the last quarter aggregated \$25,436.25. For the second and third quarters of the fiscal year the water collection exceeded requirements by \$4,293.26, which amount was placed in the amortization fund to be applied to the reduction of the cost of water-works, sewers, and pavements. In the city of Colon 731 connections have been made with water mains, and at the end of the year there were 45 applications pending. Collections in Colon from private consumers and from the commission and Panama Railroad Co. during the first three quarters amounted to \$58,631.20, and the net

amount of bills rendered for the fourth quarter was \$20,623.80. The Republic of Panama paid \$10,943.11 in order to liquidate its proportionate part of the cost of the water, sewer, and street systems. In the Canal Zone 691 water connections have been made. From the eight public markets in operation during the year a revenue of \$4,183.95 was derived in rent.

The organization of the division of schools consisted of 1 superintendent, 2 clerks, 1 supervisor of primary grades, 2 supervisors of children, 1 principal of high school, 7 principals of grammar schools, 66 teachers, and 1 gardener, the last named being temporarily employed. The school year opened October 1, 1911, with an enrollment of 2,105 children—1,174 whites and 931 blacks. On June 30, 1912, 26 buildings were used, 11 for white schools and 15 for colored schools. Medical inspection of the pupils, inaugurated during the preceding year, was continued.

The supreme court held 12 sessions during the year. It affirmed decisions of the circuit court in 4 criminal cases and reversed the ruling of that court in 1 criminal case. At the beginning of the year 4 civil cases were pending in the supreme court, 6 were filed, and 8 disposed of. In the circuit courts 567 criminal cases were instituted, out of which number there were 353 convictions, 126 acquittals, and 84 dismissals, leaving 23 cases pending at the close of the year. There were 541 civil cases filed during the year, 414 of which were disposed of and 127 were pending on June 30, 1912. In the district courts 7,128 criminal cases were instituted, 5,183 convictions secured, 1,063 acquittals, 350 dismissals, 528 appeals to the circuit courts, leaving 4 cases pending at the close of the year. There were 1,305 civil actions brought, 1,280 of which were disposed of and 25 pending on June 30, 1912.

At the beginning of the fiscal year there were \$197,207.56 in the Zone treasury, and during the year collections amounted to \$370,272.81. Expenditures for the year totaled \$312,459.75.

For further particulars concerning the work of this department, attention is invited to Appendix N.

DEPARTMENT OF LAW.

The organization and duties of the department of law were described in detail in the last annual report and remained unchanged throughout the year. The department continued in charge of Judge Frank Feuille.

Congressional legislation affecting the canal was not enacted until after the close of the fiscal year. On August 24 the Panama Canal act was made effective and the sundry civil act approved on the same date, making appropriations for the current fiscal year, contains legislative provisions affecting the canal. In addition to the fore-

going, 16 Executive orders having the effect of law were issued during the year to provide for cases and conditions which had arisen and which necessitated the enactment of provisions to cover them. Copies of the laws and Executive orders are appended hereto, marked Appendix T.

Attention has already been called to the necessity of a revision of the Canal Zone laws, in order that legislation might be brought under one complete correlated system. The zone is now governed by laws of Colombia, of Panama, by executive orders of the President, and ordinances of the commission. The head of the department of law advocates remedying the existing faulty condition by embracing in one code all the Colombian and Panaman laws which it is deemed expedient to keep and repealing all the others. A revision of the administrative laws is also necessary, but nothing was done in the direction of either pending the attitude of Congress toward the canal and the Canal Zone. The work of revision has been assigned to the department of law.

The assistant prosecuting attorney handled criminal matters in the Zone during the past year and 615 such cases were disposed of in the three circuits, of which 398 resulted in convictions, 139 in acquittals, 66 in dismissals, and 12 in which the defendants were fugitives and were not arrested. This makes a considerable increase in the number of criminal cases as compared with the previous year, due in part to the large number of prosecutions for gambling and for violations of the navigation laws; an increase in the idle population is probably responsible to some extent. During the year four criminal cases were passed upon by the Supreme Court of the Canal Zone; two resulted in affirmance of the judgment of the circuit court, in one the trial court's finding was reversed, and the fourth was a habeas corpus proceeding brought originally in the supreme court.

Cases arise occasionally in which unlawful intrusions are made upon public lands, but there is no authority for anyone in the Canal Zone to submit the title of the United States to judicial ascertainment. If the land be needed for canal purposes, the intruders are ordered to leave, and on failure to do so are ejected by the police. When the lands intruded upon are not needed for construction purposes, appeal is taken to the courts in order to evict the occupants. On this theory several suits were instituted in the courts on behalf of the commission and 225 acres of land situated between the cemetery at Mount Hope and the quartermaster's corral at Cristobal were recovered for the United States and the Panama Railroad Co. Several disputed land claims are now pending which might be adjusted amicably if the commission or its representatives were authorized by Congress to agree upon boundary lines with the claimants.

Several small tracts of lands were acquired from private persons by deed, and the claims in these cases will not be submitted to the joint commission for an adjustment of the damages. The amount aggregated approximately 979 hectares and the consideration was \$9,318. In addition 31 quitclaim deeds were taken by the Panama Railroad Co. from squatters at Toro Point; the consideration was \$5,578.

Revocable licenses to the number of 295 were issued for 315 lots in town sites, calling for an annual rental of \$2,529.09. The sum of \$1,536 was obtained from monthly licenses covering 27 rooms in houses belonging to the commission at Gorgona, and \$900 additional for the rental of one house at the same place.

For further details concerning this department, attention is invited to Appendix O.

DEPARTMENT OF SANITATION.

This department has charge of sanitary work in the cities of Colon and Panama and, except oiling, it designates the sanitary work to be done in the Canal Zone, in order to accomplish the desired ends, to the construction divisions and district quartermasters, and it exercises such supervision as may be necessary to see that the work is done properly. In addition, the department has charge of hospitals and quarantine. It is in charge of Col. William C. Gorgas, United States Army, as chief sanitary officer.

The work in the terminal cities consists in cutting grass and brush, oiling pools, constructing and maintaining ditches for drainage purposes, removal of garbage and night soil, fumigation, and street cleaning. On account of the juxtaposition of Cristobal and Mount Hope to Colon, these are included in the Colon area, and for the same reason Ancon Hospital grounds are incorporated with Panama. According to the report submitted, the work done in Panama consisted in cleaning 398 miles of ditches, digging 2.5 miles of ditches, and clearing 118 acres of weeds and grass, in addition to oiling, disinfecting, and fumigating. In the Colon district, from the same source, 112.5 miles of ditches were maintained, 8 miles of ditches constructed, and 217 acres cleared of vegetation, in addition to oiling, disinfecting, fumigating, etc.

The impression is general elsewhere than on the Isthmus that the sanitary work, in the way of clearing land, extends over the entire area included within the limits of the Zone, so that it is interesting to note in this connection that of the 278,848 acres comprised within those limits less than 1,200 acres are kept cleared for sanitary purposes and on sanitary requests, outside of the military reservations, where the work is done by the troops. What clearing may be done

around groups of squatters in the brush is not done under sanitary supervision nor for such purpose, and is relatively small. In addition, clearing is done for construction purposes, but almost the entire Zone is in its original condition as regards brush and jungle.

The total expense for sanitary work in the Canal Zone and in the cities of Panama and Colon was \$596,608.73, of which \$67,968.19 were for sanitation proper in the two cities, \$409,205.84 for sanitation proper in the Zone, \$18,672.50 for removal of garbage and street cleaning in the two cities, and \$100,760.20 for removal of garbage and street cleaning in the Zone. Of the amount expended for sanitation proper in the Zone the construction divisions expended \$89,725.17, principally in the maintenance of existing ditches and the construction of new ones for drainage purposes; the quartermaster's department, \$93,876.26 for grass and brush cutting; the sanitary department used 719,835 gallons of oil, costing \$18,862.81, and 124,718 gallons of larvacide, costing \$23,751.64; the labor expense for distributing was \$18,820.05 and \$17,514.06, respectively. All work performed by the construction divisions and the quartermaster's department was done under the direction of the sanitary department, new ditching being done in accordance with plans prepared by that department after consultation with the divisions interested. The removal of garbage and night soil in the Zone was done by the quartermaster's department.

Reporting on the health conditions on the Isthmus, the chief sanitary officer states that the total admissions to hospitals and sick camps, including those sick in quarters during the year, was 48,307; that the daily average sick was 22.91 out of every thousand employees as against 24.77 for 1910-11 and 23.01 for 1909-10 on the basis that the total numbers employed during the years mentioned were 50,008, 49,129, and 50,535, respectively; that the total number of deaths among employees was 508, of which 35 were Americans, 79 were white employees of other nationalities, and 394 were blacks; that the total number of deaths from violence among all employees was 154, as against 178 for the preceding year. In addition, on the recommendation of the medical examining board, 193 deportations were made, 141 for disease and 52 for injuries.

For further details concerning this department, attention is invited to Appendix P.

RECREATION OF EMPLOYEES.

On June 30, 1912, clubhouses were in operation at Corozal, Culebra, Empire, Gorgona, Gatun, Cristobal, and Porto Bello, under the supervision of the Young Men's Christian Association. During the

year bowling alleys, locker rooms, shower baths, and a barber shop were added to the Corozal clubhouse at a cost of about \$5,000.

The average monthly membership for the year was 1,944, as against 1,947 for the previous year. The smallest membership for any month was 1,784 for August, 1911, and the largest was 2,092 for June, 1912.

The total expenditures from commission funds for the support of these clubhouses aggregated \$50,565.61.

For further details of the operation of the clubhouses see Appendix Q.

WASHINGTON OFFICE.

The work of the Washington office was of the same scope as previously reported, and continued in charge of Maj. F. C. Boggs, United States Army.

During the year 1,296 persons within the United States were tendered employment for duty on the Isthmus in grades above that of laborer; 632 accepted and were appointed, covering 51 different positions.

The total amount of purchase orders placed for the fiscal year was \$10,446,551.23. The most important contracts entered into were for permanent equipment in the form of structural lock material, \$386,274.60; electric locomotives and tracks, \$249,258.44; spillway gates and materials, \$526,697.03; machinery for the operation of locks and spillways, \$2,271,582.01; and hydroelectric station, \$156,586.58. Other important purchases included 10,105,000 pounds of dynamite, 34,424,500 feet of lumber, and 7,259 gross tons of steel rails. Under a contract for 4,500,000 barrels of Portland cement entered into January 7, 1909, a total of 4,354,024 barrels has been shipped, of which 1,579,210 barrels were delivered during the past year.

During the year the three independent inspecting offices were continued for the inspection of lock gates and material which enter into construction of the locks and dams.

For further details attention is invited to Appendix R.

GENERAL REMARKS.

A year has passed since the last annual report, in which was noted the dates by which the various parts of the work were to be completed, and the situation has been modified somewhat, so that more accurate information can be given than was possible at that time. The division engineer of the central division reported at the close of the year that if no more material due to slides had to be removed than the increase which the revised estimates of July 1, 1912, contemplated, the excavation through Culebra Cut would be completed by July 1, 1913, or the same date as was fixed a year ago. Though additional slides have occurred since the close of the fiscal year, there has been no decrease in the force, so that it is still possible to complete it as predicted, though the date must depend upon the slides.

In the Atlantic division concrete work at the north end of the locks remains to be completed. As outlined in the report, excavation in the area below by dredging was not begun until February, 1912, and it is reported by the division engineer that, due to slides, the date for completing the concrete will now be June 30, 1913. On account of increase in the additional quantity of dry fill that must be added to the dam, July 1, 1913, is now the date fixed for completing this work, and August 1, 1913, is fixed as the date for completing the Gatun spillway.

In the Pacific division the division engineer now estimates that the locks will be completed in their entirety by January 1, 1913, by which date the dams at Pedro Miguel and Miraflores will also be finished, and that the spillway at Miraflores Locks will be completed by June 30, 1913. The delay of seven months in the delivery of the dredge *Corozal* threatened to cause a delay in completing the excavation in the channel below Miraflores by the amount that it was estimated the dredge would remove in that time. However, a large portion of this excavation will be done by steam shovels, thus reducing the length of time sufficiently to permit the completion of the channel by June 30, 1913.

As already noted, the contract for the lock gates has not been carried out as rapidly as was anticipated, and the contractor has been called upon to finish the gates in one flight of locks first, so that, if the rest of the work is in condition, passage of ships can be permitted by the use of one of the flights instead of both. While delays have occurred in the delivery of the lock machinery and accessories, the assistant chief engineer is so organizing his work as to have completed sufficient machinery to meet the conditions that the lock-gate contract will furnish. It is probable that certain features of the work will not be finished until some time after the first vessel passes the locks. These are features, such as the power-generating station, the transmission line, the aids to navigation, etc., which, though important in themselves, are not essential to the preliminary trial of the system.

The act of Congress approved March 4, 1911, provides that—

Except in cases of emergency or conditions arising subsequent to and unforeseen at the time of the passage of this act, there shall not be employed at any time during the fiscal year nineteen hundred and twelve, under any of the foregoing appropriations for the Isthmian Canal, any greater number of persons than are specified in the notes submitted, respectively, in connection with the estimates for each of said appropriations in the annual Book of Estimates for said year, nor shall there be paid to any such persons during that fiscal year any greater rate of compensation than was authorized to be paid to persons occupying the same or like positions on the first day of July, nineteen hundred and ten, and all employments made or compensation increased because

of emergencies so arising shall be specifically set forth, with the reasons therefor, by the chairman of the commission in his report for the fiscal year nineteen hundred and twelve.

In compliance with the requirements of the law, the increase in salaries and the increase in the number of employees are given in Appendix S.

The laws affecting the canal recently enacted and the Executive orders issued during the fiscal year are given in Appendix T.

The organization in effect July 1, 1912, is given in Appendix U.

Respectfully submitted.

GEO. W. GOETHALS,

Colonel, Corps of Engineers, United States Army,

Chairman and Chief Engineer.

The Hon. HENRY L. STIMSON,

Secretary of War, Washington, D. C.

APPENDIX A.

REPORT OF COL. H. F. HODGES, CORPS OF ENGINEERS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, ASSISTANT CHIEF ENGINEER, IN CHARGE OF THE FIRST DIVISION OF THE OFFICE OF THE CHIEF ENGINEER.

ISTHMIAN CANAL COMMISSION,
OFFICE OF THE CHIEF ENGINEER, FIRST DIVISION,
Culebra, Canal Zone, July 29, 1912.

SIR: I have the honor to make the following report of the operations during the fiscal year ending June 30, 1912, of the first division of the office of the chief engineer:

This division is charged with the design of the locks, dams, regulating works, and accessories; with the design and construction of aids to navigation, and with the erection of the operating machinery at the locks and spillways. In addition it is responsible for the inspection of the manufacture and of the erection under contract or otherwise of certain of the structures and machines designed in its different subdivisions.

At present the division is organized in subdivisions in charge of designs and work as follows: (*a*) Design of masonry and lock structures, including spillways and valves; (*b*) design of lock gates and protective devices, including the inspection of construction and of erection under contract; (*c*) design of operating machinery and electrical installation, including inspection and erection; (*d*) design of movable dams, including inspection of construction and of erection under contract; and (*e*) design and construction of aids to navigation.

A chart of the approved organization is herewith (plate 112).

MASONRY AND LOCK STRUCTURES.

This subdivision is under charge of Mr. L. D. Cornish, designing engineer, assisted by Messrs T. E. L. Lipsey, A. R. Brown, and L. B. Fay, assistant engineers, and the necessary draftsmen.

LOCKS.

At the beginning of the last fiscal year the general design of all the locks had been adopted, approved, and issued, except the plans of the lower portion of the lower locks at Gatun and Miraflores, and detailed drawings needed by the working force in the field had been made and issued from time to time.

During the fiscal year ending June 30, 1912, the general plans for the lower portion of the lower locks at Gatun and Miraflores were completed, approved, and issued.

All detailed plans for all the locks were completed during the fiscal year. All the decking drawings, showing details of construction over rising stem gate valve machinery chambers, miter gate moving machinery chambers, intake valve operating machinery chambers, and other miscellaneous deckings, were made and issued during the year.

VALVES AND FIXED PARTS.

At the close of the last fiscal year the designs had been completed and approved for the fixed irons for the valve and gate chambers in all locks and in the Gatun and Miraflores spillways; for the cylindrical valves for all locks, for the Stoney gates, caissons, footbridges, and railings for the spillways, and for the rising stem gate valves for the locks, including all roller trains, sealing devices, rocker bearings, etc., for the above gates and valves; for the guard valves, screens, bulkhead gates, lateral culvert valves, snubbing hooks, and bridges at intakes, and other miscellaneous ironwork.

During the fiscal year all reenforcing irons in decking over operating machinery chambers were designed and contracted for, also snubbing posts and spring buffers.

APPROACH WALLS.

At the close of the last fiscal year the designs for all approach walls at all locks had been adopted, approved, and issued, except for the south middle approach wall for Miraflores.

During the fiscal year ending June 30, 1912, the design for the south middle approach wall at Miraflores was adopted, approved, and issued, and the design for the uncompleted portion of south middle approach wall at Pedro Miguel was altered, adopting the re-enforced type in lieu of the solid type previously proposed.

DRAWINGS.

During the fiscal year 1910-11, 133 drawings were made, approved, and issued, covering the features hereinbefore mentioned.

During the fiscal year 1911-12, 181 drawings have been made, approved, and issued. The following spillway drawings have been changed and new drawings issued to replace same: 4024, 4510, 4511, 4512, 4513, 4515, 4516, 4517, 4523, and 4524. About 300 drawings have been revised. A drawing of Pedro Miguel Lock has been made for the Post Office Department, and work begun on drawing of Pedro Miguel Lock for final record.

CONTRACTS.

At the end of the last fiscal year the following contracts had been completed:

Dated July 10, 1910, with the Rosedale Foundry & Machine Co., of Pittsburgh, Pa., for 40 cylindrical valves for the upper Gatun and Pedro Miguel Locks. Total cost of contract, \$84,177.50.

Dated July 10, 1909, with the Chapman Valve Co., of Indian Orchard, Mass., for valves, expansion joints, and pipe for by-pass valves at upper end of all locks. Total cost of contract, \$4,399.80.

Dated September 7, 1909, with the Crane Co., of Baltimore, Md., for valves for by-pass valves at upper end of all locks. Total contract price, \$6,456.

Dated September 7, 1909, with Lynchburg Foundry Co., of Lynchburg, Va., for valves, expansion joints, and pipe for by-pass valves at upper end of all locks. Total price, \$9,114.90.

Dated July 10, 1909, with Penn Bridge Co., of Beaver Falls, Pa., for ladder rungs for all locks. Total price, \$2,058.40.

Dated July 10, 1909, with United Engineering & Foundry Co., of Pittsburgh, Pa., for anchor bolts, snubbing hooks, girders, cutwaters, wicket girders, seats and guides, and reaction castings for all locks. Total contract price, \$46,846.56.

Dated July 10, 1909, with the Penn Bridge Co., of Beaver Falls, Pa., for 2 sets of fixed irons for rising stem gate valves, 4 rising stem valves with roller trains and sealing devices for upper lock at Gatun. Total contract price, \$29,252.56.

Dated March 2, 1910, with the Wheeling Mold & Foundry Co., of Wheeling, W. Va., for 22 sets of fixed irons for rising stem gate valves for Pedro Miguel and upper Gatun Locks, and 18 intake valves, 12 bulkhead gates for all locks. Total contract price, \$199,106.24.

During the past fiscal year the following contracts were completed:

Dated September 1, 1910, with the Wheeling Mold & Foundry Co., of Wheeling, W. Va., for 34 sets of fixed irons for rising stem gate valves for Miraflores Locks and middle and lower locks at Gatun. Total contract price, \$225,895.61.

Dated August 11, 1910, with the Rosedale Foundry & Machine Co., of Pittsburgh, Pa., for 80 cylindrical valves for Miraflores Locks and middle and lower locks at Gatun and spillway. Total contract price, \$140,588.

Dated August 11, 1910, with Pennsylvania Steel Co., of Steelton, Pa., for snubbing hooks and girders for Miraflores Locks, and middle and lower locks at Gatun. Total contract price, \$17,216.94.

During the fiscal year 1912, the following contracts have been let on plans and specifications prepared in the fiscal year 1911:

Dated September 11, 1911, with the McClintic-Marshall Construction Co., of Pittsburgh, Pa., for 22 spillway gates, 2 steel caissons, material for 22 footbridges, 132 rising stem gate valves and 2 spares, 12 guard-gate valves, 6 lateral culvert valves, 12 bulkhead gates to middle wall culverts, 27 bulkhead gates at intakes, and 36 screens at intakes. Total contract price, \$342,681.88.

Dated September 2, 1911, with the Excelsior Tool & Machine Co., of East St. Louis, Ill., for 515 tons of fixed irons for spillways at Gatun and Miraflores spillways. Total contract price, \$25,724.12.

Dated September 11, 1911, with the Westinghouse Machine Co., of East Pittsburgh, Pa., for 264 roller trains and 4 spares and 292 sealing devices and 32 spares for rising stem gate valves in all locks, 46 roller trains and 2 spares, 52 sealing devices and 8 spares, rocker bearings and tracks for spillways at Gatun and Miraflores spillways. Total contract price, \$177,147.58.

Dated August 21, 1911, with the Vulcan Rail & Construction Co., of Brooklyn, N. Y., for material required for 22 sets of bridge railings for Gatun and Miraflores spillways. Total contract price, \$5,665.

Dated December 26, 1911, with the United States Steel Products Co., 30 Church Street, New York City, for material for four intake bridges at upper end of Pedro Miguel and Miraflores Locks and structural material for decking over rising stem gate valve and miter gate moving machinery chambers of all locks. Total estimated cost, \$21,414.97.

The following contracts have been let on plans and specifications prepared during the fiscal year 1912:

Dated November 23, 1911, with the Standard Foundry Co., 743 Hartel Avenue, Buffalo, N. Y., for snubbing posts and washers for all locks. Total contract price, \$5,518.09.

Dated November 23, 1911, with the American Car & Foundry Co., 165 Broadway, New York City, for bolts, links, anchor rods, etc., for buffers on all lock walls. Total contract price, \$6,257.02.

Dated December 21, 1911, with the Railway Spring & Steel Co., New York City, for 25,608 helical springs for spring buffers on approach walls of locks. Total contract price, \$13,572.24.

Dated November 11, 1911, with J. B. Kendal Co., of Washington, D. C., for cold twisted square steel bars for reenforcing deckings over miter gate moving and rising stem gate valve machinery chambers for all locks. Total contract price, \$1,059.35.

Dated January 5, 1912, with the United States Steel Products Co., of 30 Church Street, New York City, for triangular mesh slab reenforcement for deckings over rising stem gate valve and miter gate moving machinery chambers at all locks. Total contract price, \$891.44.

CASTINGS MADE ON THE ISTHMUS.

In addition to the ironwork made in the United States the commission foundry has made or fabricated, in accordance with the designs of this subdivision, about 5,361 tons of castings and structural material. (Nine hundred and fifty-four tons of material was furnished during the fiscal year 1910-11.)

INSTALLATION OF VALVES, GATES, ETC.

The work of preparing chambers for and installation of rising stem gate valves was begun during this fiscal year, and 14 chambers (12 at Gatun and 2 at Pedro Miguel) were prepared for valves, and 12 valves have been placed in position in lock. Six bulkhead gates have been placed in side-wall intakes and six in center-wall intakes at Gatun. The three rising stem gate valves and one cylindrical valve have been placed in spillway, and all cylindrical valves have been placed at all locks.

About 90 per cent of the material for the two caissons, 22 spillway gates, and 22 spillway footbridges has been delivered, and the erection of the caissons and gates in the yards was about to begin at the close of the fiscal year. The placing of all this material will be done by the commission during this fiscal year.

TESTS OF VALVES.

The details of construction of the rising stem valves for the main culverts are illustrated in plates 69, 70, and 71 herewith. The plates show slight changes from the valves illustrated in the annual report

for 1909, the changes having been made after contracting for the first two experimental sets. For test under working pressures a set of two valves was installed in the upper valve chamber of the west side culvert at Gatun, the entrance to the culvert was closed with a watertight bulkhead, and the culvert above the valves, with the well connecting the same to the top of the wall, was filled with water. When the water reached the coping level there was a head against the valve slightly greater than that which will obtain when the lock is pumped dry for examination and considerably greater than the usual operating head. Under this condition the leakage was measured, and also the force required to start the valve and to maintain motion for a distance of about 1 foot. The leakage was as follows:

	Cubic feet per second.
28-foot head above bottom of valve.....	0.75
48-foot head above bottom of valve.....	1.46
53-foot head above bottom of valve.....	1.56
79-foot head above bottom of valve.....	1.82

The following table gives the result of the test made under full head, i. e., with the surface of the water 79 feet above the bottom of the valve. It will be seen that the combined friction resulting from the contact of the side seals of the gates, as well as the action of the roller trains, averages 21,170 pounds. It had been assumed as 31,750 pounds in the design of the machinery, which was intended to exert a lifting force of 60,000 pounds, including all friction and the weight of the valve and its accessories. The valve tested was one of the first made and lacks certain improvements in details and workmanship which are found in those of later manufacture and which would undoubtedly reduce the friction and leakage somewhat.

Tabulation of tests of rising stem gate valves.

No.	Designation.	Gate.	
		260	261
		<i>Pounds.</i>	<i>Pounds.</i>
1	Pull to lift gate, no water pressure.....	24,000	25,000
2	Weight of gate, plus one-half weight of roller trains.....	23,000	23,000
3	Friction of side seals, initial (1-2).....	1,000	2,000
4	Friction of side seals, due to water pressure.....	4,170	4,170
5	Friction of side seals, total (3+4).....	5,170	6,170
6	Water pressure against gate, calculated (h=79 feet).....	651,000	651,000
7	Water pressure against upper seal, lifting force.....	5,420	5,420
8	Dynamometer pull to start motion.....	37,500	40,000
9	Total upward force, initial (7+8).....	42,920	45,420
10	Dynamometer pull, maximum during 12-inch travel of gate.....	41,500	44,500
11	Total friction, sliding plus rolling (9-2).....	19,920	22,420
12	Rolling friction, initial (11-5).....	14,750	16,250
13	Coefficient of rolling friction (12+6).....	0.0226	0.0231

One of the cylindrical valves in the locks at Gatun was tested for leakage from the exterior by constructing a bulkhead across the entrance to the valve chamber. The valve chamber was filled with water under pressure. When the head reached 60 feet, the leakage was found to vary from a quantity too small to measure to about 0.25 cubic foot per second. The average was about what was to be expected from the previous tests made and described in the last annual report. Close examination indicated that the leather seal or

gasket was sufficiently rigid to hold up the movable portion of the valve and prevent its seating properly. The segments which clamped the leather seal were removed and the edge beveled slightly to allow an easier bending of the gasket. After this operation the leakage was found, by measurement, to be about 0.015 cubic foot per second, or about one-tenth of that previously measured. The segments for all the valves are now being beveled in the manner indicated as advisable by this experiment.

The details of construction of the cylindrical valves will be found illustrated in the annual report for 1909.

LOCK GATES AND PROTECTIVE DEVICES.

This subdivision has been under the immediate charge of Mr. Henry Goldmark, designing engineer, assisted in the office by Messrs. F. E. Sterns, L. A. Mason, and J. Soderberg, assistant engineers, and the necessary draftsmen and clerk.

The force organized for inspection of lock gates in the United States was under the immediate charge of Mr. J. Hammer, assistant engineer, and Mr. Frank Price, chief inspector. Mr. George F. Guynn was the chief inspector on the Isthmus.

LOCK GATES.

The fixed metallic parts embedded in the masonry, such as the anchorages, sill reenforcement, quoin and foundation castings, etc., furnished under a contract with the United Engineering & Foundry Co., of Pittsburgh, Pa., had been delivered prior to the beginning of the fiscal year 1912. All these parts have been erected by the division engineers.

The construction and erection of the lock gates proper and of the fixed parts necessary for supporting the gates on the foundation castings and fastening them to the anchors have been carried on under the contract with the McClintic-Marshall Construction Co., of Pittsburgh, Pa., dated June 21, 1910. During the year the shop drawings for all the different heights of gates were completed by the contractors and approved.

The inspection of the material for the gates in the rolling mills, foundries, and the contractor's works at Pittsburgh was continued in essentially the same manner as in the previous fiscal year. The only change of importance was the transfer of the inspection at the foundry of the Wheeling Mold & Foundry Co. from inspectors reporting to the Washington office to a force under the direct orders of the assistant engineer in charge of the lock gates.

The inspection of the hand railing and its mechanism, as well as of a few minor parts, is still being carried on by the commission inspectors engaged on other duties in connection with the Washington office.

The total steel plates and shapes accepted at the mills to the end of the fiscal year aggregated 52,322 tons, half of which was rolled during the year. This practically comprises all rolled material required for the gates, excepting that for the spare parts.

The manufacture of the steel castings, both of ordinary carbon steel and the vanadium steel alloy used in certain parts of the gates,

was continued in a satisfactory manner. At the end of the fiscal year about three-quarters of all castings had been cast, machined, and accepted.

All specified chemical and physical tests have been carried out, and the contract requirements as to the quality of material were in all cases fully met.

The only change in the material for any part of the gates was made in the bushings for the pintles at the bottom of certain leaves that will always be in sea water. In order to avoid possible damage through electrolytic action these bushings will be made of hard cast vanadium steel instead of the manganese bronze used in the other gates. Certain of the other leaves which will be operated in brackish water are to be protected from corrosion by the use of zinc rings placed close to the bronze bushings.

Two other modifications in the gates may be mentioned here. One of them concerns the coating of bitumastic enamel, which, by a modification in the contract, is to be applied to all the inside surfaces, while originally only the upper surface of the horizontal girders and the vertical surfaces for 10 inches above the same were to be coated with this compound. The extra cost involved by this change is \$158,000. The other change in plan is the addition of a rubber seal to the bottoms of the gates to prevent leakage at the sills. The simple device which has been adopted for all the gates, together with the general plan of the sills, is shown on drawing No. 5012 (pl. 72) and will, it is believed, successfully accomplish its purpose and considerably reduce the waste of water at the gates. A seal of this kind is thought to be novel for use with lock gates.

The fabrication of the riveted structural steel was continued at the contractor's works at Rankin, Pa. A high degree of accuracy in laying out the several parts in the shops has been attained and the workmanship was excellent in every respect. As a result very few errors have been discovered in the field, and the gate leaves when erected are exceptionally straight and true, as well as water-tight. The holes for the field rivets have been subpunched or drilled in the shop to a uniform diameter of $\frac{11}{16}$ inch for $\frac{7}{8}$ inch and 1 inch rivets, although the specifications permit somewhat larger holes. Consequently there are very few oblong rivet holes when the field reaming is completed.

The total shipment of structural material—i. e., plates, shapes, and riveted parts—to the end of the fiscal year 1912 aggregated about 39,000 tons, or 76 per cent of the amount required for all the gates. Of the above total about 32,000 tons went forward during the fiscal year.

On June 30, 1912, a total of 13,000 tons remained to be shipped, comprising about half the material for the gates in the intermediate lock at Gatun and the upper lock at Miraflores, and all the material of this grade for the gates in the lower lock at Miraflores. At the present rate of progress the steel work for all the lock gates and the spare parts provided for in the contract will be completed in the shops before November 1, 1912.

The first material to be erected under the McClintic-Marshall contract was put in place in the locks on March 21, 1911, when the first bearing plates were attached to the hollow quoins in the upper lock at Gatun. The erection of the lock gates proper was started May 17,

1911, when the bottom girders for the upper guard gates at Gatun were lowered into position.

By the end of the fiscal year 1911 the skeletons of these gates had been erected for one-third of their height, and a small amount of riveting had been done.

In the Pacific division work was begun August 7, 1911, on the upper guard gates at Pedro Miguel.

The work of erection has proceeded throughout the year at varying rates of speed.

On June 30, 1912, work was in progress on 23 gates, or exactly half of the total number on the canal, but none of these gates had been entirely completed. They comprised all the gates in the upper lock and the intermediate gates in the lower lock at Gatun, and all the gates at Pedro Miguel excepting the lower guard gate in the western chamber. No material had been put in place at Miraflores.

The gates under construction were in all stages of progress; in some only part of the steel was in place; in others all the material had been raised, but only the interior rivets in the skeleton had been driven. In the gates that were further advanced toward completion the reaming of the holes for the field rivets and the driving of these rivets had progressed in varying proportions.

The only gates which had been stepped on the pintles and attached to the anchors were the upper guard gates at Gatun. These gates were very nearly completed by the end of the fiscal year. The work remaining to be done on these leaves, besides the erection of the foot-walk and its railing, was the adjustment of the metallic bearing faces along the quoin and miter posts and the sill timbers, and the testing of one of the gates for water-tightness; also the cementing of the bottom girder and the interior and exterior painting on both of the gates.

None of the other gates had been completely riveted up, and practically none of the castings for the bearings along the quoin and miter posts had been attached.

The total steel in place in the several gates at the end of the fiscal year amounted to 19,631 tons, out of a total of 58,000 tons, or about 34 per cent, but much of this was only partly reamed or riveted. All of this material, with the exception of 412 tons previously raised, was erected during the fiscal year.

The total number of field rivets driven to June 30, 1912, practically all of them during the fiscal year, was 963,500, out of 5,750,000, or only 17 per cent of the total.

The completion of the several gates has fallen considerably behind the dates specified in the contract. This has been due in part to the failure of the contractors to deliver the necessary material and tools on time and in part to the limited number, and in some cases to the poor quality of the force of mechanics and laborers. This has been the case especially in the field riveting and the machine work, etc., necessary for the complete erection of the gates.

A close and continuous inspection has been necessary, but it is believed that the completed gates will be entirely up to the standard laid down in the specifications and equal to or superior to similar work elsewhere. The tests for water-tightness made in the first gate at Gatun indicate excellent workmanship in this respect.

The progress of the work is shown in photographs. (Plates 1 to 6.)

METHODS USED IN ERECTING LOCK GATES.

The method of erection and character of the plant employed is described as follows by Designing Engineer Goldmark:

The erection of the lock gates forms a part of the contract with the McClintic-Marshall Construction Co., the method of erection being left to the contractors, subject to the approval of the chief engineer of the commission.

Drawing No. 5091 (plate 73) has been compiled from the plans for the erection submitted by the contractors and approved on the part of the commission, and, in connection with the photographs of the gates and the description of the plans, should give a clear idea of the methods used. The means adopted for handling the material and for moving the leaves into place are novel but simple, and are believed to be an advance on previous practice. They have proved entirely successful.

The gates are of the straight type, having a uniform width of 7 feet and a length of nearly 65 feet. The main operating gates are 77 feet, 77 feet 10 inches, 79 feet, and 82 feet high, the heights of the different guard gates being 47 feet 4 inches, 54 feet 8 inches, and 66 feet. Their frame or skeleton consists of the horizontal girders spaced from 3 feet 8 inches to 5 feet apart, of vertical frames extending the entire height of the leaf, of the intercostals, which stiffen the sheathing plates at intervals of about 2 feet, and of two vertical diaphragms for transferring the thrust of the leaves along the quoin and miter posts to the web plates in the horizontal girders. Sheathing, doubling, and cover plates are attached to the upstream and downstream sides of the main frame, and the ends are closed by flat plates connected to the skeleton by continuous bent plates. The lower part of the gate forms an air chamber subdivided by three water-tight bulkheads, while the upper portion is arranged to permit the water to flow in and out freely. To the vertical ends of the riveted structure just described, which comprises about nine-tenths of the material in the leaf, steel reaction castings are attached, which are shown in section in figures 8 and 9, drawing 5091. (Plate 73.)

The bearing plates, which are of hard rolled nickel steel, are secured in continuous recesses in these castings, being bolted to them and backed up by bab-bitt metal during erection. The leaf rests on a hemispherical pintle secured to the masonry, while at the top it is connected to the anchorage by a vertical pin.

The horizontal girders, with their stiffening angles and beams, are riveted up complete in the United States, and, together with the vertical frames, diaphragms, and intercostals, as well as the plating, are delivered at the locks ready for erection.

No difficulty has been experienced in delivering the material in good condition, although besides the ocean transfer it is transported by rail both in the United States and on the Isthmus. The girders, some 1,500 in all, which are 65 feet long and weigh as much as 18 tons each, are carried both as deck loads and in the holds of the steamers, but very few of them have sustained serious injury. The material is received at the lock site by rail and stored on the back filling close to one of the side walls. There are, as a rule, two or three storage tracks parallel with the walls. Their general arrangement is shown on figure 1. The track nearest the lock is 150 feet from the edge of the wall and connected by a curve of 90° to the rails on the erecting bridges when they are in place for the erection of the several gates. These bridges and their position when in use are shown in figures 2, 3, and 4, as well as in some of the photographs. They are supported on the coping close to its edge. When they are to be moved the trusses are lengthened so as to clear the gate recesses by temporary extension pieces, also shown on the plan. When passing from one lock level to the next, it will probably be necessary to take down and reerect these bridges. Eight spans in all have been provided, so that erection proceeds on 16 leaves at once.

With trifling exceptions all material is handled by self-propelling or locomotive cranes, of which the contractor has 10 in use. With these cranes the steel is unloaded from the cars as it arrives from the docks and handled during the subsequent sorting. As the erection proceeds the same cranes serve for picking up the separate girders and other parts from the storage piles, loading them on flat cars, towing the same out on the erection bridges, and afterwards lowering the steel members into their final positions in the lock gates. The erection bridges and cranes take the place of expensive false work and derricks,

and have proved efficient and economical. It should be noted that all material is stored on one side wall only, and reaches both lock chambers by the erection bridges exclusively.

The work of completing the gates ready for operation is divided into several distinct parts. In the first place, comes the erection proper—that is, the putting in place of the material in the structural frames. Second, the reaming of the rivet holes, the driving of the field rivets, and the necessary calking. Third, the finishing, which includes the attachment and adjustment of the reaction castings and bearing plates, the moving of the leaves into position on their pintles, and their attachment to the anchorages; also the testing for water-tightness, the adjustment of the sill timbers, and the erection of the footwalks and of various minor parts, as well as the painting.

The erection proper begins, in the case of each leaf, with the placing of the bottom girder. The upper pintle casting, so called, which rests on the fixed pintle, also the large heel casting just above this girder, and the reaction frame at the miter end, are riveted and bolted to the girder in the storage yard and all necessary joints are fully calked. In view of the considerable weight to be handled, amounting to 24 tons for the high gates, two cranes are used simultaneously in lifting the bottom girders into the flat cars, and for lowering them into the lock pit. For all other material one crane is amply sufficient.

At the bottom of the lock the girders are placed on rolled beams, which are supported in part on the sill walls and in part on small temporary pedestals of concrete. As shown in figure 2, the leaf is placed 4 feet from its final position on the pintle, and at an angle of about 45° with the lock walls. The blocking is just high enough to permit the bottom of the gate castings to clear the pintle when the leaf is being rolled into position.

The rest of the skeleton is built up on the bottom girder, the vertical frames and diaphragms being attached before the successive girders are lowered into place. The intercostals are as a rule attached later.

It is very important that the gates shall be exactly true in shape, and great stress has been laid on accuracy in the shop, as well as when erecting the framework. A special machine was installed in the contractors' works, by which both ends of the girders are planed at the same time. This machine is to remain unchanged in position until all the girders are completed. The results obtained by its use are very accurate. In the field fine steel wires are used to check the shape of the skeleton as erection proceeds and all observed errors are promptly corrected. It is believed that the greatest deviation from a plumb line in the ends of the frames will not exceed one-eighth inch for any of the high gates. In order to insure a correct total height in the gates, adjustable fillers are used between the vertical diaphragms and the girders at the top of every fourth panel from the bottom. The heights of all completed gates agree within less than one-fourth inch with the figures shown in the plans.

The erection of the framework is completed, as a rule, before the attachment of the sheathing plates begins, although in some cases a part of the plates were placed before the erection of the skeleton reached the top. The interior rivets connecting the different parts of the skeleton to each other are driven during its erection or shortly thereafter, but all of this riveting must be completed before the sheathing is entirely in place. All plates are lowered into position by the cranes standing on the erection bridges and attached to the framing at the proper places, but no attempt is made at this time to complete the adjusting and bolting. They are merely fastened by a small number of bolts, so that the bridges may be released as soon as possible and moved into position for erecting the next set of gates.

After the erection proper is completed, the work next to be done is the exact fitting and bolting of the sheathing plates, the reaming of the rivet holes, and the driving of the rivets. Very complete bolting is insisted upon, in order to insure good reaming and tight rivets.

The holes for the rivets which connect the sheathing plates to the skeleton have been punched or drilled in the shops to a uniform diameter of $1\frac{1}{8}$ inch for both $\frac{7}{8}$ and 1 inch rivets, and are reamed out to full size in the field. The diameter of the holes before reaming is smaller than that specified, but was adopted by the contractor in order to insure good fitting, a result that has been fully attained. In view of the large number of holes (55,000 in the larger leaves and over 4,000,000 in all gates) to be reamed, a special machine was designed with which the greater part of the work is being done. This machine is a large electrically driven shop tool by which, if desired, two holes spaced $3\frac{1}{2}$ inches apart, as in the cover plates, can be reamed at the same time. Sixteen such machines are in use. A large number of the holes, including all those on

the curved parts of the upstream face, and others difficult to reach, are being reamed out with small hand reamers, mainly driven by compressed air. While the work done by the large reaming machines is excellent, it is questionable whether there is any decided advantage in their use.

The riveting and calking calls for no detailed mention from a technical standpoint, as standard pneumatic riveters are used for practically all rivets. The output per machine has, however, been small, owing largely to the employment of inexperienced local labor, and the progress has been slow. As there are nearly 6,000,000 field rivets to be driven, a delay in this part of the work is, of course, serious.

After the reaming and riveting of a gate are completed, the castings must be attached along the quoin and miter posts and the leaves placed into position on their pintles. As noted above, the leaves are erected a short distance from their final position. The appliance for moving them consists of structural-steel frames, which are shown on figures 2, 5, and 6, and also in several of the photographs. These frames are of sufficient strength to support the weight of the completed gates, which are attached to the frames by temporary bolts. It was at first proposed to place the frames adjacent to the gates as soon as three or four panels of the skeleton were erected, and to depend upon the frames to give lateral stability to the leaves. In practice, it was found that when used in this way the frames interfered with the attachment of the sheathing and with the driving of many of the rivets. At present, guys are used to steady the gates and the frames are not put in place until after practically all rivets are driven. They are readily handled by locomotive cranes standing on the lock walls. As shown in detail on figure 7, there are rollers and wedges at the foot of the main posts by which the gates suspended between the frames are rolled into position over their pintles and lowered upon them. No trouble has been experienced in this operation, the time taken being, so far, about two days per leaf. Hydraulic jacks are used for moving the leaves forward.

The connection of the gates to the anchor at the top is readily made by wedges, the pin being placed vertically over the pintle below and a correct adjustment obtained by the use of fillers in the anchorage castings.

It may be of interest to note the great stiffness of the leaves, which is evidenced by the fact that in the case of the guard gates the total deflection at the foot of the miter post did not exceed one-eighth inch when the leaves were suspended from their anchors.

Along both the quoin and miter posts metallic bearings are used in place of timber. Figures 8 and 9 show the details adopted. Heavy steel castings are embedded in the concrete at the hollow quoins and similar castings are attached to the ends of the gates by bolts and rivets. In order to obtain an exact bearing, and also to provide for easier renewal, separate bearing plates are fastened into machined recesses in these castings. The hollow quoin castings were set in the concrete during the construction of the walls, and many of them show considerable deviation from an absolutely correct position. The erection and adjustment of the bearing plates formed a part of the gate contact and preceded the erection of the gates themselves. The plates are attached to the castings by 1-inch bolts placed 17 inches apart. Their exact adjustment is made by these bolts and by temporary stud bolts placed at intervals of about 2 feet along the center line of the plates. A fine steel wire is fastened at the top and the bottom of the quoin so as to pass exactly through the center to which the curved surfaces of the bearing plates are to be set. These wires are fixed in position by reference to a plumb line placed directly over the center of the pintle below. By using a flat metallic template, which is curved on one side to the correct radius and notched at the other to indicate the center, the several quoin plates are readily revolved about their axis and shifted forward and backward into correct positions. Even with errors of as much as three-eighths to one-half inch in the position of the castings there has been no difficulty in setting the bearings exactly, although a small amount of grinding was at times necessary. Extreme care has been taken to get the best possible results, and it is believed that the deviation in the bearing surfaces rarely exceeds four to five thousandths of an inch from an absolutely correct position, except where the machining in the shops was defective.

After the plates are exactly aligned, melted babbitt metal is poured into the spaces between the plates and the castings through some of the bolt holes used for adjustment. These are used as pouring holes at intervals of about 4 feet. After a little practice, no difficulty was experienced in pouring the metal successfully. A rather large melting pot is desirable, and a high temperature. To

avoid explosions from dampness, it has proved necessary to blow hot compressed air into the spaces to be filled, just before pouring. The joints between the bearing plates and castings are finally calked. The castings along the gate leaves are attached and secured to same before the gates are moved.

In order to insure a good bearing between the castings and the end plate on the gate frame, the latter are carefully ground with emery wheels. No attempt is made to obtain an absolutely true plane for the whole height of the leaf, as minor errors are readily corrected by the adjustment of the bearing plates. The deviation from a true plane is, however, very small. The grinding has for its purpose the obtaining of good contact between the individual castings, which are a panel in height, and the end plates. An exact contact is insisted upon along the outer edges of each casting, and also opposite the reaction diaphragms, but small depressions at other parts of the surface are permitted.

The adjustment of the wedge-shaped plates between the castings and the sides of the structural frame is somewhat difficult, and many of the bolt holes have to be reamed from the inside of the leaf. After the leaf is in correct position on the pintle, with the bearing plates loosely attached to the reaction castings, the final adjustment of the plates is made. For the quoin end this is done by placing the leaves in their correct closed position against the sill and then forcing the several bearing plates against the fixed plates in the hollow quoin. This is done by means of the bolts which fasten the plates to the castings and of small temporary bolts or jacks attached to the ends of the permanent bolts and bearing with their other ends against the opposite surface of the casting. With the plates thus firmly held, the gate is revolved into a wide-open position and the plates babbitted through holes in their faces. Figures 8, 9, and 10 show these bearings and the small jacks used for adjustment. It may be noted that there is sufficient room for adjusting the bolts when the leaves are closed, and also that the bearing is accessible for pouring the babbitt and for possible future renewal of the bearing plates when the leaves are wide open.

A very close adjustment has, in the manner just mentioned, been made in the case of the first two gates so far finished. It should be added that the leaves are always adjusted in the early morning, when the temperature is lowest and the gates are at a uniform temperature in all their parts. It was expected to adjust the bearings at the miter posts in the same way by bringing the two leaves into a correct closed position and pressing the bearing plates against each other by means of jacks. The variations in the lengths of the leaves from temperature changes, even within a very short period of time, have made it necessary to abandon this method. It also proved difficult to hold the tops of the leaves in a fixed position with reference to each other. The method which seems to give the best results is to close the leaves, bring the plates at the top and bottom into contact, and, after fixing them in that position, to open the leaves and adjust all the bearings on each miter post to a true line between the top and bottom. This is done by the use of the fine wires and the adjusting bolts, and, after babbitting, the gates are brought together, so that irregularities may be observed and corrected by grinding. In order to counteract possible slight drooping of the leaves, it may prove best to use a small spacer between the two bearings at the top when first adjusting the top plates at the miter posts.

The adjustment of the timber at the sill is made after the miter and quoin bearings are completely finished. These timbers rest in castings with a space about 1 inch wide for grouting. Hence they can readily be pressed against the gate leaves when they are closed, bolted fast, and afterwards grouted.

The final work is the testing of the leaf for water-tightness. In order to do this, it is blocked up securely and the entire air chamber filled with water, the manshaft being also filled to the top of the leaf, giving a head at the bottom equal to the full height of the gate. Any leaks along the calked seams or at the rivets are at once corrected by calking. The tightness of the bulkheads subdividing the air chambers is afterwards tested by successively emptying the several compartments, thus exposing the bulkheads to one-sided pressure.

The leaves so far tested have shown but very few and unimportant leaks, so that the gates were made absolutely water-tight in a few hours.

The testing of the downstream sheathing above the air chambers can not be undertaken until the locks are filled with water, so that the leakage on the downstream side may be observed and errors corrected.

CHAIN FENDERS.

The studies made for the chain fenders and the design selected for the construction of a trial unit were fully described in the annual report for 1911. The design as shown on drawing 5224 (Pl. No. 81 of that report) was completed in detail during the early part of the present fiscal year and bids were invited for the construction of the machinery under Circular No. 649, to be submitted November 4, 1911. On the basis of the proposals received, a contract was let to the lowest bidder, the United Engineering & Foundry Co., of Pittsburgh, Pa., for the delivery on the Isthmus of all parts of the fender, excepting the chain proper, the water tank; the resistance valves, the pumps, the motors, and the electric and signal apparatus.

The heavy riveted anchors embedded in the masonry had been previously built at the commission's shops on the Isthmus.

The above contract covers the machinery for one fender delivered at Colon, the price being \$21,113 for this unit, but the commission reserves the right to purchase the material for the other 23 fenders at prices named in the contractor's bid. The pumps and motors were let to the General Electric Co., under Circular No. 681, the pumps to be built by the Cameron Pump Co., of Phillipsburg, N. J. The contract prices for this material delivered on the Isthmus are as follows: Two pumps for the first chain fender, \$975; forty-six pumps for remaining fenders, \$22,252; motors for same, \$2,132 and \$27,002, respectively.

The electric control was advertised for under Circular 679 and let to the General Electric Co., and the signal apparatus, advertised under the same circular, was let to the Union Switch & Signal Co.

To determine the best form of emergency resistance valve, an elaborate series of tests has been made in the power plant of the Prudential Insurance Co., at Newark, N. J. Three types of valve have been tested under conditions approximating those of actual operation, two of the valves giving satisfactory results under test.

No material for the fenders had been shipped at the end of the fiscal year except the chain for the first fender, which was built at the United States navy yard at Boston. It is believed that the machine parts for the first fender will be shipped from the United States in July, so that erection can begin about September 1, 1912.

It should be added here that a large amount of time has been spent in this subdivision during the year in working out the detailed plans for the decking of the lock walls over the machinery rooms for the fender chains. Owing to the very limited head room and varying amount of space available, considerable study has been necessary.

FLOATING CAISSON GATES.

Work on the detailed drawings for these gates has been continued during the fiscal year on the basis of the general design described in the last annual report. The plans for various decks, etc., have been drawn out and a detailed study made of the pumps and piping. Owing to the pressure of other work, the amount of time devoted to the caissons was comparatively small.

RECESS COVERS.

All material for the structural steel covers by which the electric locomotive track is supported over the recesses of all the lock gates, excepting the lower guard gates, was delivered during the fiscal year by the United States Steel Products Co., the contractors for the manufacture of this metal work.

The erection in the field was let to the McClintic-Marshall Construction Co. by a contract dated July 7, 1911.

By the end of the fiscal year they had practically completed the erection of all the covers in the Gatun and Pedro Miguel locks, but had done no work at Miraflores. Parties operating under the machinery-erection force were engaged in concreting in place the beams of the covers after erection under contract.

CONTRACTS.

During the fiscal year contracts have been made for work under this subdivision as follows:

For pumps and motors for unwatering gate leaves, with Alberger Pump Co. and the General Electric Co., respectively.

For motors for hand-rail gearing, with the General Electric Co.

The above-named material is included in contracts for other material advertised under Circular 681.

Dated May 4, 1912, with the Earle Gear & Machine Co., of Philadelphia, Pa., for hand-rail gearing for lock gates. Total contract price, \$5,360.

Dated July 7, 1911, with the McClintic-Marshall Construction Co., of Pittsburgh, Pa., for erection of lock-gate recess covers. Total price, approximately, \$30,000.

Dated December 5, 1911, with the United Engineering & Foundry Co., of Pittsburgh, Pa., for fender chains. Total price, \$21,113 for one unit; \$428,005 for 24 units.

OPERATING MACHINERY.

This subdivision has been under the charge of Mr. Edward Schildhauer, electrical and mechanical engineer. The designing and drafting has been carried on with the assistance of Messrs. C. B. Larzelere, W. R. McCann, and C. C. Coppin, assistant engineers, and the necessary draftsmen and clerks. Mr. Frank A. Browne, assistant engineer, has had the immediate charge of the inspecting force in the United States, and Mr. E. E. Lee, superintendent of erection, has directed the erecting force on the Isthmus.

RISING STEM AND CYLINDRICAL VALVE MACHINES.

The first two machines furnished by the Wheeling Mold & Foundry Co. were tested at the works of the manufacturer and found to be satisfactory, after which the commission exercised its option, and contract was entered into December 5, 1911, with this company for the furnishing of all parts for 114 rising stem gate-valve machines, without motors. After successful test of the first two cylindrical valve machines at the works of the manufacturer, the Wheeling

Mold & Foundry Co. was also awarded the contract on October 25, 1911, for 118 additional cylindrical valve machines, without motors, and 12 auxiliary culvert valve machines, without motors.

Two trial machines of each kind were ordered in March of last year from the Wheeling Mold & Foundry Co. The cylindrical valve machines were received on the Isthmus October 23, 1911, and the rising stem gate-valve machines January 2, 1912. The latter Nos. 260 and 261, are now installed complete; were tested in June, 1912, and found to be satisfactory. Shipment was begun in April on the main order of 114 rising stem gate-valve machines and 118 cylindrical valve machines from the works of the contractor, but delay has been caused by the strike of stevedores at Baltimore, the point of shipment. Up to June 30, 1912, a total of 21 rising stem valve machines (except valve stems and thrust screws), 34 cylindrical valve machines, and 3 auxiliary culvert valve machines have been received.

Owing to the peculiar climatic conditions of the Isthmus, involving tropical heat and extreme humidity, and the deteriorating effect of these conditions on the insulation of electrical machinery, it was necessary to investigate thoroughly the different kinds of insulation available for use on the lock machinery. Accordingly, the sample motors ordered under Circular 614, as reported in the last annual report, were subjected to very careful tests. Sixteen sample motors in all were purchased. Eight of these motors were first sent to the machine contractors for operating tests on valve machines. The other eight motors were shipped direct to the Isthmus.

These motors were subjected to a very extensive and complete series of tests, in which the insulation was subjected to the extreme conditions specified in the circular.

The eight motors shipped direct to the Isthmus were first placed in a storehouse at Gatun, where they were exposed to the ordinary conditions of climate, for a period of about two months, during which time the condition of the insulation was periodically determined by inspection and tests.

In order to expedite the action of the heat and humidity, it was proposed to subject the motors to a steam test, in which the extremes of temperature and humidity mentioned might be reproduced. Accordingly, a small building was erected at Gatun in which these tests were conducted. In order that the test conditions of all motors might be identical in all respects, the motors were placed in this building and tests performed on all motors simultaneously, so that the motors were subjected to the same humidity and temperature for the same lengths of time. Briefly, the tests consisted of filling the building in which the motors were located with steam, thereby maintaining a temperature of 50° C., for a period of 10 days, making potential tests and measurements of insulation through the period of test. The precaution of placing all motors in the same house and of performing simultaneous tests on all motors was taken in order that exactly the same conditions would exist for all of the motors tested. The tests were conducted without the presence of any representatives of the manufacturers. The arrangements were briefly as follows:

A 2-inch steam pipe was installed at the center of the room near the ceiling. The motors were distributed about the room so that the

motors of the same make were not together, nor in the same relative position. To obtain the desired temperature control, a regulating valve was installed in the steam pipe, and thermometers were located at 14 different points around the walls of the building, these thermometers being read from the outside of the building. The adjustment of temperature was made by admitting air through openings located about 4 feet above the floor around the walls of the room to obtain a uniform temperature, as shown on the various thermometers.

At the start of this steam test the motors were subjected to a potential test of 1,500 volts for one minute. Thereafter they were subjected to tests of 1,000 volts for 10 seconds, each 24 hours. Also, during steam test, measurements of insulation resistance were made at intervals of six to eight hours. Before the start of the steam test all motors were run light for a short time under normal conditions on a 220-volt, 3-phase circuit. All finished parts of the motors were treated with a coating of graphite and oil before the steam was turned on the first time. The terminals of the motors were also protected by a covering of rubber tape.

In making the high potential tests the terminals of all motors were connected to a common bus, the frames being likewise connected to a common ground. The buses were then made alive through hook switches and the potential raised to test voltage and maintained for the specified period, when it was again lowered and current cut off. As the test progressed it was not possible, nor desirable, to maintain the secondary voltage at desired value after the insulation of one or more motors had weakened or broken down. It was therefore necessary to test the motors separately after they had once broken down. Usually 100 or 200 volts was sufficient to indicate on primary ammeter that insulation of motor was defective. During the period of the steam tests the observations of insulation resistance were plotted, and a complete record of the condition obtaining throughout the test was kept. For the 10 days following the steam test the motors were allowed to remain under normal conditions of room temperature and humidity. Such motors as had broken down under the steam test and did not recover in the following 10 days were taken apart to facilitate examination of the windings, the case and rotor being removed. The faults on these motors were located as far as possible.

In order to determine further the possibility of clearing faults on the windings by drying out, the motors having sufficient insulation were run light on normal voltage. The other motors were heated by current from a rheostat, the insulation resistance being measured at frequent intervals. It was further proposed as a test of the insulation to actually immerse the motors in water. The motors which had survived the steam test were therefore given this additional test, which, briefly, consisted of filling the case with water at a temperature of approximately 30° C. and maintaining this condition over a period of about five hours, during which time observations of insulation resistance were made continuously. After this period the water was removed and the motors were allowed to dry out, first under room temperature and then with internal heat applied by current from a rheostat, and finally by running the motors light.

The remaining eight motors which were first shipped to the machine contractors were not subjected to the steam test, but, after reaching the Isthmus, were given immersion tests similar to those above de-

scribed. The motors were first run light in order that they might be thoroughly dried out, observations of insulation being taken at frequent intervals throughout these runs, and serving as an indication of their condition. After the five-hour immersion the water was removed and motors put through drying-out process, first under room temperature, then with internal heat, and finally by running light, as before. The motors which had sufficient insulation resistance were run light on the day following the immersion test.

The relative standing of the various types of insulation in these tests was in general definite, and the choice of the most suitable insulation was clear; however, in view of the number of motors tested, it was desirable to obtain a numerical basis of comparison of the various motors. A schedule of the various stages of the tests was therefore prepared and a number of points assigned for the survival of each of these stages. The motors were given four points for surviving the test; three, if after failure during the test the insulation recovered without repair; two, if after such failure the insulation was found possible of repair; one, if after repair the motor recovered; and none if they failed to recover at all. The total points for each of the four motors representing the manufacturer in the entire series of tests then served as an index from which the relative value of the insulation could be determined.

On the basis of the tests as above outlined, the contract was awarded to the General Electric Co. on the alternative bid, for 114 motors for the rising stem gate valve machines, 118 motors for the cylindrical valve machines, and 12 motors for auxiliary culvert valve machines, at a total price of \$121,515.20.

LIMIT SWITCHES.

A series of tests was also made on the sample limit switches purchased under Circular 614. The tests consisted of insulation and potential tests under the climatic conditions of the Isthmus, and while these tests were not as extensive as the motor tests, sufficient information was obtained to determine the suitability of the various bids and make the award on this class of apparatus.

Contract was entered into with the Cutler-Hammer Manufacturing Co. for 114 limit switches for rising stem gate valve machines and 118 limit switches for cylindrical valve machines, in exercise of option reserved by the purchase of the trial equipment. The contract price for these switches was \$5,586 and \$5,782, respectively, for the rising stem gate valve machines and the cylindrical valve machines. Satisfactory progress has been made in the manufacture of these switches, and 50 are reported as having been shipped from the works of the manufacturer to date.

HOISTING MACHINERY FOR EMERGENCY DAMS.

The Otis Elevator Co. is building the emergency dam and gate and girder hoisting machines designed in this subdivision, and the contract for the electrical equipment has been placed with the General Electric Co., and is inspected under this subdivision of the office.

Satisfactory progress has been made during the year. The first machine of each type has been tested and the other machines have

progressed to the extent that they will soon be ready for tests. Tests of the worm gearing were carried out at the works of the Otis Elevator Co., and the motor characteristics and the hand-operating mechanism adapted to the results of the tests.

TOWING DEVICES.

A report of awards under Circular 619 for towing-locomotive track was given in the last annual report. The condition of the work is as follows:

Class 1. Structural steel parts, furnished by the United States Steel Products Co. This contract is over 95 per cent completed.

Class 2. Considerable difficulty has been experienced by the contractors in producing steel castings for the rack sections, which are sufficiently accurate for the purpose intended. The subcontractor, the Pennsylvania Steel Co., experimented with the sections until they produced a satisfactory product, and the delay involved thereby has practically been overcome by the recent deliveries being in excess of schedule. The delivery of steel rack sections is 44 per cent completed.

Class 3. Malleable iron supporting brackets for the conductor slot covers; contractor, Ross-Meehan Foundry Co. Sixty per cent of the brackets furnished by this contractor have been delivered to the Isthmus, but were rejected on account of general irregularities. Malleable iron cover plates and washers, furnished by the same contractor, have been completely delivered.

Class 4. Copper conductor rails and splice bars for towing track. Bids obtained on material covered by this class of the original circular were rejected and readvertised under Circular No. 647. Most of the bidders submitted prices on a copper conductor rail of the rolled structural T section, but the irregular surface obtained made it unsuitable for the purpose intended. Contract was placed with the Wheeling Mold & Foundry Co., the lowest bidder, on October 16, 1911, for approximately 700,000 pounds of extruded copper T conductor rail for the towing tracks and approximately 16,000 pounds of copper splice bars for the same, at 20.7 and 27.95 cents per pound, respectively.

Class 5. Crossovers and turnouts. The bids received were unsatisfactory. All bids were rejected, and the material was readvertised under Circular 688. The original bids on this class ranged from \$146,466 to \$324,030. The readvertisement, which was accompanied by more complete detail drawings than the first advertisement, resulted in the United States Steel Products Co. being the lowest bidder, and the contract was entered into with that company on April 26 for \$44,142, exclusive of some items which were purchased under the increase clause of other existing contracts, amounting to \$15,000. This readvertisement resulted in a saving, in round numbers, of \$87,000 to the commission.

The electric towing locomotive was described in the annual report of 1910. Certain modifications were made in the design from that previously described. Circular 650 invited bids, and the policy was pursued, as in the case of other machines, namely, to ask price on sample machine and also on the remainder should the sample prove satisfactory. The circular called for bids on 1 and on 39 electric towing locomotives. Six bids were received, of which that of the

General Electric Co. was the lowest. Their total price for the 39 locomotives will be approximately \$456,300, or about \$11,700 each. This price is \$325 a ton, or 16.1 cents per pound. The cost of the first locomotive is \$24,951. Award was made to the General Electric Co. for the first locomotive, decision as to the balance to be made after it has been tested.

MITER GATE MOVING AND MITER GATE FORCING MACHINES AND MOTORS
FOR SAME.

(Circular 627.)

The machines for operating the lock gates were described in the annual report for 1910, and the last annual report gave a review of the bids and respective prices.

Contract was given to the Wheeling Mold & Foundry Co. at the close of the last fiscal year (June 22, 1911) for the first two miter gate-moving machines and on the same date the Richard Manufacturing Co. was given contract for the first miter forcing machine.

These were completed and satisfactorily tested in the works of the contractors and were shipped to the Isthmus and received in January. The miter gate-moving machines have been installed in their respective places and one tested in regular service of swinging a gate in the dry. The operation was successfully performed in 1 minute and 48 seconds, this being 12 seconds less than the estimated time. These tests were satisfactory, and the Wheeling Mold & Foundry Co. was given contract for the remaining 90 miter gate-moving machines on February 11, 1912. At the close of the fiscal year shipment has been started from the works of the William Tod Co., subcontractors to the Wheeling Mold & Foundry Co. Shipment is to be completed May 1, 1913.

The installation of a miter forcing machine has not been completed, as the structural features of the gate were not ready to permit of its installation.

The award for the motors was withheld until the results of the tests, described hereinbefore, conducted under Circular 614, should be known. Instructions were issued from the Isthmus under date of May 9 this year for placing the award with the General Electric Co. for the entire number of motors for miter gate-moving and miter forcing machines. The award for miter forcing machine motors being conditional and dependent on a decision to use this machine on all gates.

The award for the main quantity of miter forcing machines has been withheld until a test is obtained with the sample machine erected in place on the miter gate.

VITRIFIED TILE DUCT.

This circular covered vitrified tile ducts for power and control cables in the lock walls and connecting the locks with the power stations. One million five hundred thousand duct feet were ordered from the Shawmut Clay Manufacturing Co. at a unit cost of 5.69 cents per foot, or \$85,350. The delivery is practically completed.

HYDROELECTRIC STATION.

Specifications were issued September 9, 1911, covering the main generating equipment for a hydroelectric station containing three 2,000-kilowatt units, to be located adjacent to the spillway in Gatun Dam. The equipment is to consist of three 2,250-kilowatt water turbines, three head gates, three penstocks, three governors, three draft tubes, three 2,000-kilowatt generators, three direct-connected 50-kilowatt exciters, two 100-kilowatt motor-driven exciter sets, one 30-ton electric crane, and one lubricating system.

Bids were opened in Washington on October 9 and canvassed on the Isthmus upon their arrival. The award of the hydraulic equipment, class 1, was made November 28, 1911, to the Pelton Water Wheel Co., and contract was entered into December 2 with promise of delivery in 150 to 195 days for the water wheels and governors, 125 to 150 days for the penstocks, and 90 to 120 days for the head gates.

Award was made for the electrical equipment, class 2, to the General Electric Co. November 28, 1911, and contract entered into December 2, with promise of delivery as follows:

	Days.
Generators -----	170-200
Exciters -----	140-160

The crane, class 3, was awarded to the Niles-Bement-Pond Co. January 6, 1912, and contract drawn under date of January 19, with promise of delivery in 100 to 120 days.

The cost of the three classes is as follows:

Class 1 -----	\$85, 834. 50
Class 2 -----	54, 599. 00
Class 3 -----	7, 445. 00
	147, 878. 50

At the close of the year one generator was completed and ready for test at the works of the contractor. The only material delivered on the Isthmus is 60 per cent of the penstocks. Every effort is being made to have the remainder of this material on the Isthmus at an early date, and the latest advices from the States indicate that complete shipment will be made by June 29, 1912.

From the storage in Lake Gatun there will be available sufficient water to warrant the installation of 6,000 kilowatts in generating capacity, including reserve. The average head throughout the year will be approximately 75 feet, the elevation of the tail race being about 8 feet above sea level. During the rainy season water will be plentiful and must be wasted over the adjacent spillway. During the dry season, however, it will be necessary to draw upon the storage in Gatun Lake. The maximum quantity of water diverted for hydroelectric development is approximately 7 per cent of the minimum water supply, and is the excess which is not required for lockages, evaporation, and leakage.

AUXILIARY ELECTRICAL EQUIPMENT FOR GATUN HYDROELECTRIC STATION.

Circular 715 was issued on June 8 covering the auxiliary equipment of the hydroelectric station, consisting of switchboards, lighting transformers and power transformers for the spillway, air compressor,

storage battery for emergency lighting and switch control, and the crane equipment. Bids on this circular are to be opened on July 8.

SPILLWAY GATE MACHINE AND PUMP.

The spillway gate machine is designed to raise or lower in approximately 10 minutes a spillway Stoney crest gate for controlling the water levels of Gatun and Miraflores Lakes. It consists essentially of two counterweights, one at each end of the gate, connected to the gate at each end by a screw and chain, the screw being moved vertically by means of a worm nut which is motor driven by a worm. The two screws at the gate ends are driven simultaneously through a driving shaft which is provided with a worm at each end for operating the worm nuts. The screws are held in a vertical position and the hoisting chains pass over sheaves at the tops of the gate piers.

The counterweights practically balance the weight of the gate, so that the machine has to overcome only the resistance to movement of the gate due to water pressure.

The machinery tunnel extends the full length of the spillway within the dam and contains all the operating machinery. The screws for lifting the gates pass through this tunnel, extending downward to the counterweights and upward to the hoisting chain through openings provided for the purpose.

The limit switch, geared to the driving shaft, prevents overtravel at the two ends of travel of the screw by cutting off current from the motor in the direction of travel. The limit switch allows the motor to be reversed at the ends of travel or at any intermediate point.

Circular 661 invited bids for 22 spillway gate machines, without motors or limit switches, and for three small portable pumps, complete with motors, for emptying the counterweight pits, in which seepage water will originally be allowed to accumulate.

Seven bids were received for the spillway-gate machines, of which that of the Steacy-Schmidt Manufacturing Co. was the lowest. Its total price for the 22 machines, including spare parts, was \$70,542. The unit price of a machine per pound, not including the spare parts, is 14 cents, or price per ton, \$281.65. The counterweights for these machines are being manufactured on the Isthmus at a unit cost of 1.75 cents per pound.

Three bids were received for the pumps, and award was made to Henry R. Worthington, the lowest bidder, after an investigation of the insulation proposed for the motor. Their price for the three pumps is \$821.25. The Westinghouse Electric & Manufacturing Co. is the maker of the motors for these pumps. Drawings No. 6702 to cover appended hereto. (Plate 74.)

LOCK-CONTROL AND INDICATING EQUIPMENT.

On January 31 specifications were issued for the purchase of apparatus for the remote control and indication of the lock machinery and spillway gates. The system includes starting panels for the various sizes of motors, limit switches, and special switches, such as a commutating switch for the miter-gate control and an auxiliary cut-out switch for the miter-gate strut, handrail controllers, etc.; also remote indicators for showing at the control switchboard the positions of the various machines during operation, indicators for the

various water levels, local indicators for the chain fenders, and control switchboard for each of the three groups of locks, from which all regular operating machinery will be controlled by means of interlocking switches.

The bids were opened in Washington on March 15 and canvassed on the Isthmus. There were three bidders—the Cutler-Hammer Manufacturing Co., the Union Switch & Signal Co., and the General Electric Co. There were only two complete bids, that of the Cutler-Hammer Manufacturing Co. and that of the General Electric Co.

The General Electric Co. was considerably lower in price for the complete equipment, except the local indicators for fender chains, and instructions for placing award with them for all except the local indicators were sent to the Washington office on April 15. The local indicators referred to, of which only a trial equipment is being ordered at present, were awarded to the Union Switch & Signal Co., the lowest bidder.

The character of the drawings submitted with the lowest bid rendered it necessary to make the award tentatively in the case of certain classes, particularly class 4, the control boards with the interlocking switches, until the bidders could demonstrate more fully that the apparatus proposed would comply with the specifications. It was also desired to obtain a demonstration of the accuracy of the indicators, especially the float-well indicators, and to require some minor changes in the control panels before making the award final.

The amounts involved are as follows:

General Electric Co., all items except local indicators for chains-----	\$199, 631
Union Switch & Signal Co., local indicators (trial equipment)-----	450
Union Switch & Signal Co., remaining quantity (not yet ordered)---	10, 350
	210, 431

PUMPS AND MOTORS.

There will be a total of 966 permanently installed motors used for diverse purposes in all locks. Motors to drive the rising stem gate valves, the cylindrical valves, and the miter-gate machinery were included in the specifications for the machines. Under Circular 681, 327 motors, not included in the purchase of the machines, were contracted for, and covered motors for all remaining machinery and pumps. These specifications were for motors of various capacities, and detailed stipulations for the purchase of 207 centrifugal pumps and the control and starting equipment of 149 of these pumps. The largest of these pumps are to be used to operate the manipulations of the hydraulically driven chain fender machine. The majority of the pumps are of smaller capacity, used to clear various sumps and drainage pits of bilge. The different pumps, with rated capacities, are tabulated as follows:

Pump.	Quantity.	Gallons per minute.	Head.
			<i>Feet.</i>
1. Chain fender pumps.....	48	1, 200	Variable.
2. Chain fender sump pumps.....	48	200	65
3. Miter gate sump pumps.....	92	75	90
4. Drainage sump pumps.....	9	800	15
5. Main culvert pumps.....	3	4, 200	50
6. Portable pit pumps.....	7	100	100

Circular 681 was issued February 7, and awards made April 29 in accordance with the following tabulation:

327 motors to the General Electric Co.....	\$106,490.18
60 pumps to the General Electric Co. (Cameron Steam Pump Co., makers).....	26,921.50
147 pumps to the Alberger Pump Co.....	21,860.78
308 float switches, starters, etc., to General Electric Co.....	12,882.20
80 handrail gearings to Earle Gear & Machine Co.....	5,360.00
	173,514.66

Deliveries are promised for the principal items on dates varying from July 15 to November 15, 1912.

INSULATED CABLE.

Circular 695 was issued March 20, calling for prices on an assortment of 41 sizes and kinds of cable, said prices to hold good for a period of 15 months from April 3, 1912.

On May 1, to the General Electric Co., the lowest bidder on this class, award was made for 140,000 feet No. 0000 B. & S. 3-conductor, varnished cambric, lead-covered cable, and 30,000 feet No. 00 B. & S. 3-conductor, varnished cambric, lead-covered cable, at a total cost of approximately \$132,000.

The control cables were originally called for in 7, 13, and 19 conductor sizes, as these lay up most economically in the finished cable. It was intended to make a 19-conductor cable serve two or three adjacent machines. Later, upon more detailed consideration of terminal connections, it was decided to adhere more closely to individual cables for each machine; also, the bids on control and indicating apparatus were received and the exact number of conductors required became known. As a result it now becomes advantageous to employ 5 and 8 conductor cables, and prices have been asked from all bidders on this kind of cable with varnished cambric insulation.

Varnished cambric insulation will be used as far as possible, but there will be some cases where the conductors can not be readily protected by lead covering, and in such cases rubber insulation will be used.

TRANSFORMER ROOM EQUIPMENT.

For the purpose of supplying the 966 motors which drive the lock machinery with electric current, there are provided throughout the three groups of locks a total of 36 transformer rooms—16 at Gatun, 8 at Pedro Miguel, and 12 at Miraflores. Each transformer room is practically an independent substation, interconnected with the others in the same locks by means of primary feeders. Power is taken at 2,200 volts from the hydroelectric station (or other transmission line substation) and is transformed to feeder pressure at 220 volts. The transformer rooms are all located near the heavy motor-load centers. Each of the large motors is to have an independent feeder of 4/o capacity, and provision will be made to cut one motor over upon an adjacent feeder by means of a semiflexible, portable, cable interconnection.

Each transformer room is to contain two 190-kilowatt power transformers, either one of which can carry the motor load of the section

fed from one transformer room. All equipment, including primary feeders, will be in duplicate to insure continuity of service. In addition to the power transformers, each room will contain a 25-kilowatt lighting transformer, a bank of 9 or 10 oil switches, a seven-panel low-tension switchboard, and miscellaneous cable and terminal equipment. One of the seven panels of the switchboard is to be a lighting panel, containing circuit breakers for the exterior lamps and branch switches for tunnel and machine-room lamps. In the design of the transformer room every effort was made to render all operations simple and fool-proof, and painstaking care was used to avoid the possibility of shutdown and operating troubles.

The design of the transformer room was started and completed during the year, specifications were issued April 22, and bids were opened May 22 and sent to the Isthmus for canvassing. Award has not yet been made.

MISCELLANEOUS MATERIAL.

Circular 666 was issued December 7, 1911, covering miscellaneous material for rack railway and miter gates, including track bonds, flexible and solid conduit, conduit fittings, steel splice bars, asbestos pads for the conductor rail, insulators, etc.

The bids were not canvassed on the Isthmus, but awards were made by the Washington office. Some trouble was experienced in getting suitable conduit both of the rigid kind and the flexible for the necessary wiring on the top of the miter gates, but this was finally adjusted. A quantity of junction boxes were originally included, but boxes suitable for the service could not be obtained, and it was decided to design them here and have them made at the Gorgona shops.

The bonds and track supplies have been received complete, but not the conduit.

COVER SEATS FOR CRANK-GEAR MACHINERY RECESSES.

Specifications were issued December 13, 1911, and contract was given to the Standard Foundry Co., of Buffalo, N. Y., January 4, 1912, covering a total of 92—aggregating 719,152 pounds—cast-iron and cast-steel cover seats at a total cost of approximately \$30,421, or 4.23 cents per pound. A total of 32 per cent has been delivered.

CAST-IRON COVERS.

Approximately 824 tons of handhole, manhole, and cast-iron and reenforced-concrete machinery-room covers are being manufactured on the Isthmus at a unit cost of 3 cents per pound.

LOCK ILLUMINATION.

The general features of the lock illumination—both exterior on the coping and interior in the operating tunnel and the machinery rooms—have been fixed during the year, and specifications are about to be issued covering the purchase of the required lighting material. The illumination work has necessitated the drafting of some 25 detail drawings and wiring diagrams.

For lighting the exterior of the lock walls and the lock chambers, it is proposed to erect concrete lamp standards on approximately 100-foot centers throughout the entire length of each wall. The concrete standard is of special design and is arranged to support a so-called canal type of reflector, about 30 feet above the coping level. The reflector is designed to throw the lighting flux of a 400-watt tungsten lamp outward over a ship in the lock chamber, and also to produce a uniform illumination over the surface of the wall, without the glare occasioned by the intrinsic brilliancy of the lamp shining directly into the eye of an approaching pilot. Each lamp standard is to be supplied with an outlet box, which contains receptacles for inserting portable lamp and telephone circuits. In all, there will be on the lock walls alone 211 lamp standards at Gatun, 131 at Pedro Miguel, and 169 at Miraflores, a total of 511.

Deck lights in the roof of the operating tunnels will admit sufficient light in the daytime to permit of circulation. For use at night, or when repairing machinery, artificial illumination is provided by the ordinary 16-candlepower carbon-filament lamps mounted in specially designed reflectors, which are set in the concrete of the ceiling and walls. A total of nearly 7,000 lamps will be installed in all locks.

In general, the lamps—both exterior and interior—are to be connected on alternate circuits, to avoid local total darkness resulting from a burn out on one circuit, and also to conserve power whenever a mild illumination only is required.

GUARD-VALVE MACHINES.

Work on the redesign of machinery for operating the guard valves was resumed in April, 1912. Drawings and specifications are in course of preparation, and invitation for proposals will be asked in the near future.

TRANSMISSION LINE.

Considerable study has been given to the design of the transmission line which will connect the hydroelectric station at Gatun with the locks of the Pacific division. Need was established during the year for further transmission lines to the various fortifications, and some further study has been given to this feature. Provision will also be made for a possible electrification of the Panama Railroad. As yet no final design has been approved; but the attention of several designers is about to be given to this one undecided feature of the permanent electrical system.

INSPECTION OF MACHINERY AND ELECTRICAL EQUIPMENT.

The force handling technical matters relating to inspection of electrical and mechanical equipment has been continued throughout the year in connection with contracts for machinery heretofore described under the heading "Operating machinery." The headquarters of this force has not been changed during the year. The inspection work under the jurisdiction of this force has required, so far, a maximum of 44 inspectors, at an average salary of \$127.20 per month, in addition to the office force provided for in the organization.

During the year inspection has, at various times, been carried on at the works of 275 different main and subcontractors on contracts aggregating \$3,803,000. Inspection on completed contracts, at an aggregate price of \$421,663, was carried out during the year. The remaining uncompleted contracts are now under inspection.

The valve stems and thrust screws for the rising-stem gate-valve machines were ordered by the contractors in Dusseldorf, Germany, and Trollhattan, Sweden, and arrangements were made, through the general purchasing officer and the Department of State, securing the services of local inspectors for these items.

Inspection has been performed by this force for the general purchasing officer on contracts amounting to about 2 per cent of the total above given. In connection with inspections made, 1,548 drawings have been checked and approved, and 11,492 determinations made in the chemical laboratory connected with this branch of the inspection service. This laboratory was placed in operation in August, and to the close of the fiscal year the average unit cost of determinations has been 43 cents. Of the total determinations made, approximately 5 per cent were made for and at the request of other branches of the inspection service. This laboratory was established to avoid claims for delay on the part of contractors, as by this method returns are available in the case of ferrous samples, as a rule, on the day the sample is received. Ordinarily two days are required for the analysis of copper and tin alloys.

The total cost of maintaining this inspection force has been well within the estimate made at the time it was decided to organize it.

ERECTION OF MACHINERY.

Active field work was begun at the Atlantic locks in September, 1911, and at the Pacific locks in January, 1912. Offices for the supervisors were erected, storage sites laid out, storage space arranged, and lines and grades established for the erection of the various machines. Other preparatory work that was possible before the receipt of machinery has been taken up as fast as the organization could be increased to handle it, such as the making up of templets and jigs, preparation of masonry and fixed ironwork, equipping tool cars and rooms, making up concrete trains, arranging for compressed air, and light and power service.

Owing to delay in the receipt of machinery, the schedule of erection has not been adhered to in all cases. The installation and erection of machinery are progressing as fast as deliveries permit. The two machines, each secured on trial orders, for the rising stem gate valve machines, cylindrical valve machines, and miter gate moving machines have been erected and tested under conditions approaching normal operation as closely as feasible.

The miter-forcing machine secured on trial order has not been erected, no gates being yet completed. It has, however, been given a preliminary test and is in condition to be installed at the earliest opportunity.

Nine thousand four hundred and fourteen feet of towing track, including conductor slot channels, have been assembled, lined up, and tested with a pinion mounted on a special truck. A trial length of conductor slot of 200 feet has been installed with the exception of insulators and conductor bar.

In setting machinery and towing track and miter gate recess covers a total of 2,348.9 cubic yards of concrete has been laid by the division.

With the start of the erection of the lock machinery and electrical equipment it became necessary to assemble tools and construction plant for the Pacific and Atlantic locks. This plant consists, chiefly, of an air compressor, 6 one-half yard portable motor-driven mixers and various air and motor driven tools, and 10 locomotive cranes, 8 of which (15-ton locomotive cranes with auxiliary hooks and lines at a price of \$63,000, not including the cast-iron counterweights) were purchased on contract from the Industrial Works, of Bay City, Mich., and 2 were transferred from other divisions.

SPECIAL REPORTS.

Several detail reports have been prepared on various subjects, principally the following:

On July 22 a report was submitted by a committee, consisting of representatives from each of the lock divisions and the electrical and mechanical engineer, proposing a division of responsibilities between the divisions constructing the locks and the first division doing the erection work.

A report was submitted to the head of the first division on August 9 on the subject of the Isthmian Canal Commission furnishing electricity commercially throughout the Canal Zone for light and power purposes.

A detailed report is being prepared, at the close of the year, on the subject of furnishing light and power to the fortifications.

GENERAL.

In addition to the various features which have been described under the circular numbers and other headings, there has been considerable additional work of a general character. Drainage plans for the lock walls have been completed. Plans have been prepared and issued covering the laying of tile ducts in the operating tunnels of the lock walls in so far as these can be laid by the respective divisions in advance of installing machinery and cables by the first division.

Plans and specifications have been prepared in this office for a transformer substation for the Panama Railroad for supplying power to the Balboa dock cranes.

Many drawings or sketches have been prepared for special features of the work and particularly for erection purposes. This includes special tools and templets for the erection of machinery or checking the correctness of same and special track plans.

In all, 181 regular drawings have been completed during the year, and 125 sketches, 110 small sketches, diagrams, etc., in addition to many study sketches.

INSPECTION OF EMERGENCY DAMS.

This work has been under the immediate charge of Mr. T. B. Monniche, designing engineer.

On July 8, 1911, the headquarters of the inspection force was transferred to Edgemoor, Del. At this plant the major portion of

the detail drawings for the emergency dams was checked and approved, a system for keeping full record of all material manufactured was worked out and the necessary forms secured for the use of inspectors, and the organization of the office and inspection force was completed, the office force consisting of the designing engineer, one clerk, one checker, and two inspectors, and the inspection force in the field consisting of nine inspectors, one chemist, and one assistant chemist.

A chemical laboratory was installed at the plant of the Carnegie Steel Co., Homestead, Pa. The building was provided by the Carnegie Steel Co., who also furnished the electric current, gas, water, and steam for use in the laboratory. At the commission's expense a complete equipment for making analyses of material entering into the construction of the emergency dams was installed, the original expense of this installation being approximately \$1,200.

On December 6, 1911, the headquarters was transferred to Ambridge, Pa., office room being provided by the American Bridge Co. in their office building at this place.

Due to the variety of material specified for use in the dams, it was necessary to perform inspection work at 53 different plants of sub-contractors.

Rigid inspection at all points has been maintained during the entire progress of the work, and all material has been thoroughly inspected at the mills and foundries.

All steelwork entering into the construction of the dams is thoroughly cleaned of all mill scale, rust, etc., before painting is allowed to proceed. The structural work is pickled or sand blasted, depending upon the size of the pieces, before assembling into the various members.

The required specimen tests, chemical and physical, have been made and passed by the various inspectors. The finished work is likewise being inspected with the same thoroughness.

As called for in the specifications of Circular 616, the gates and yokes have been provided with roller bearings. The roller bearings for all dams have been completed at the end of the fiscal year, but, in accordance with the specifications, they will not be accepted until the full-size shop tests of the gates have been made and accepted. The results of the full-size tests of the roller bearings indicate that for gate No. 1, about 6 per cent of the weight of this gate will be sufficient for lowering it in the current; for gate No. 2, about 8 per cent of the weight of the gate; and for gate No. 3, about 9 per cent of the weight of the gate. The specifications call for one-half of the total weight of the gate to be sufficient for lowering in the current. The indications of the preliminary tests are therefore very favorable. Compression tests were also made upon individual rollers. The maximum estimated load on one bearing is 32,750 pounds. If this load be considered to be distributed over three rollers, the maximum load on a roller would be 10,900 pounds, which compares very favorably with the average yield point of 163,300 pounds, this being close to the ultimate strength. No permanent set was found in the rollers under a load of 63,000 pounds. Chemical analysis was also made of the material entering into the construction of the chrome-

vanadium rollers and tool-steel sleeves, and the following analysis shows the composition of these materials:

	Carbon.	Manga- nese.	Sulphur.	Phos- phorus.	Silicon.	Chro- mium.
Chrome steel rollers.....	1.05	0.23	0.034	0.017	0.26	1.20
Tool steel sleeves.....	1.05	.28	.035	.019	.19	.....

Investigation has been made of a suitable grease to be used in the above roller bearings.

To prevent moisture from entering, felt washers have been placed around the axles of the bearings. Two grades of washers were submitted by the contractor, one made of hard felt and the other of soft felt. Tests showed that the soft-felt washers gave the greater water-tightness, there being a slight leakage even with them.

Fitted to the gates and having their axles running in the above-mentioned roller bearings there are 2,016 flanged vanadium case-hardened gate wheels, 12 wheels being fitted to each gate. The chemical properties of this steel are approximately as follows:

	Per cent.
Carbon.....	0.240
Phosphorus.....	.012
Silicon.....	.140
Sulphur.....	.025
Manganese.....	.500
Chromium.....	.900
Vanadium.....	.210

As evidenced by the numerous physical tests made upon specimen test pieces, the average physical properties of this metal is as follows:

Yield point, 76,000.
 Ultimate strength, 96,000.
 Elongation in 2 inches, 20 per cent.
 Reduced area, 60 per cent.
 Fracture: Cup.

As called for in section 172 of Isthmian Canal Commission Circular 616, the contractor is to make five full-sized gate tests. These tests are to determine the general working of the gates when subjected to the loads they will be called upon to bear in actual working. No tests have been made upon the gates at the end of the fiscal year, but the contractor has built the necessary piers and the rails upon which the gates are to be placed have been set in place upon the piers.

As result of tests, it has been deemed advisable to use, in the place of the babbitt metal proposed for the main pinion shaft and the intermediate shaft journals, phosphor bronze bushings of the following composition:

	Per cent.
Copper.....	79.7
Tin.....	10
Lead.....	9.5
Phosphorus.....	.8

According to the specifications a great number of the important castings of the emergency dams are made of vanadium steel. The

castings being furnished have the following average physical properties:

Yield point, 46,000.
 Ultimate strength, 76,000.
 Elongation in 2 inches, 25 per cent.
 Reduced area, 36 per cent.

The average chemical properties of the vanadium steel castings are as follows:

	Per cent.
Carbon-----	0.280
Phosphorus-----	.033
Silicon-----	.300
Sulphur-----	.040
Manganese-----	.620
Vanadium-----	.180

Since the emergency dams are constructed on the same principle as the center-pivot draw span, the center pivot of the dams will be subjected to unusually heavy working loads. The weight of the dams, which is estimated to be 6,700,000 pounds for each of the dams at Gatun and Pedro Miguel, is transmitted from the main trusses to the center cross girders and thence to the casting forming the top part of the pivot. This casting weighs approximately 8,600 pounds. The bottom surface of the top casting bears upon an upper disk, flat on the top and concave on the bottom surface. Into this concave surface is accurately fitted a center disk, convex on both sides, the lower surface of which is accurately fitted into the concave upper surface of the lower disk, a disk similar to the upper disk but reversed in position. The lower disk, being flat on the bottom surface, bears directly upon the base casting, a large casting weighing approximately 34,000 pounds and embedded about 3 feet in the concrete pier. A cast box, made in halves so as to facilitate removal, incloses the disks. This box is for the protection of the disks and the retention of the lubricant for the pivot.

The two upper and lower disks are made of forged chrome vanadium steel. The physical properties of this steel are as follows:

Elastic limit, 175,000 pounds per square inch.
 Ultimate strength, 200,000 pounds per square inch.
 Elongation in 2 inches, 8 per cent.

This steel has an average chemical composition as follows:

	Per cent.
Carbon-----	0.350
Manganese-----	.850
Sulphur-----	.027
Phosphorus-----	.025
Silicon-----	.140
Chromium-----	.990
Vanadium-----	.220

These disks are 43 inches in diameter and each 5 inches in thickness through the center, the approximate area of each is 1,452 square inches; therefore the minimum unit pressure is 6,700,000/1,452, or 4,620 pounds per square inch. This is the highest unit pressure that has ever been used in a similar location. Blanks for these disks are cut from a sand-cast ingot. After forging into shape the disks are then carbonized for about six days at a temperature of 1,850° F. and then air annealed. After the air annealing the disks are machined

to a true radial surface. They are then reheated to a temperature of 1,600° F. and quenched in water. The disks, being turned within one thirty-second of an inch of the final size, are then shipped to the point of assembling and the concave surfaces of each ground and polished to gauge.

Between the upper and lower steel disks there is placed, as noted before, a forged manganese bronze center disk. This disk is also 43 inches in diameter, but is 7 inches thick through the center. For testing purposes three test pieces were cut from each disk. One piece was cut radially to the disk, one tangentially, and the third was cut by a hollow drill through the center of the disk. The material of this disk is of exceptionally high quality, as evidenced by the following average physical properties, it being added that the results obtained from each set of test specimens did not vary more than 5 per cent:

Yield point, 90,000.
 Ultimate strength, 120,000.
 Elongation in 2 inches, 18 per cent.
 Reduced area, 15 per cent.

The following is the average chemical composition of this metal:

	Per cent.
Copper-----	66.84
Zinc-----	20.43
Manganese-----	3.17
Aluminum-----	6.22
Iron-----	2.14
Silicon-----	Trace.
Undetermined-----	1.20

The bronze is first made by the regular crucible process, and after a sufficient quantity has been melted it is poured into a chilled iron mold approximately cubical in shape. Sufficient excess is cast to the ingot—about 20 per cent of the weight on the ingot—to allow turning off the head and thereby securing solid metal. The piece is then heated to a forging temperature, about 1,600° F., and forged into the approximate shape of the center disk. After forging the disks the test specimens are cut from the blank in the manner given above; and if the tests prove satisfactory, the disk is rough turned prior to shipment to the point of assembling. The disks are then turned and polished to gauge and grooves cut on each convex surface for grease.

Tests were made by the commission to determine a suitable grease for lubricating the surfaces of the disks.

It is of interest to note the physical properties of the nickel-steel eyebars being furnished for the emergency dams, as indicated both by the full size and specimen tests. The specimen tests are taken before annealing, and the full-size tests, in which the bar is tested to destruction, are taken after annealing.

<i>Specimen test.</i>	<i>Full-size test.</i>
Yield point, 58,500 pounds per square inch.	Yield point, 57,000 pounds per square inch.
Ultimate strength, 100,000 pounds per square inch.	Ultimate strength, 95,000 pounds per square inch.
Elongation in 8 inches, 15 per cent.	Elongation in 12 inches, 33 per cent.
Reduced area, 27 per cent.	Reduced area, 34 per cent.
Fracture, $\frac{1}{2}$ cup.	Fracture, silky.

The chemical properties of the nickel steel eyebars are as follows:

Carbon	0.330
Phosphorus	.015
Silicon	.090
Sulphur	.030
Manganese	.590
Nickel	3.300

The annealing of the eyebars has been performed with great care, and the satisfactory results, as shown by the above tests, are in a large measure due to the annealing treatment.

At the close of the fiscal year, 1,096 detail shop drawings have been approved by the commission, 1,017 of these being the total number required for Gatun and Pedro Miguel Dams, the remaining 79 forming part of the necessary drawings for the Miraflores Dams, which are similar to those for Gatun and Pedro Miguel, varying principally in bills of material.

At the end of the fiscal year there has been accepted at the various plants of the contractor the following material:

Nickel structural steel	Tons. 4,182
Carbon structural steel, turned bolts, checkered floor plates, etc	2,702
Carbon-steel forgings	325
Carbon-steel castings	845
Vanadium gate wheels	137
Vanadium-steel castings	370
Bronze	14
Cast iron	16
Pig iron	700
Hand-rail pipe	50

Roller bearings for all dams.

At the end of the fiscal year, 2,786 tons of material had been shipped from the plants of the contractor. It is expected that all of the structural material for the first two dams will be shipped from Ambridge, Pa., before July 15, and from Pencoyd, Pa., it is estimated that all material for the first two dams will be shipped before August 1.

Due to a stevedores' strike in the United States, shipments of material to the Isthmus were somewhat delayed and thereby also the erection work. By the end of the fiscal year 1,000 tons of structural material and machinery parts and 700 tons of pig iron for counter-weights had been received on the Isthmus and delivered at the sites. The contractor has completed the false work and the erection cranes for the east dam at Gatun, which will enable him to begin work immediately upon receipt of those pieces which are first required for the erection, these pieces being expected within two weeks from the end of the fiscal year. No work has been done at any of the other dam sites.

On the 15th of April the designing engineer left the United States for the Isthmus to take charge of the inspection of the erection of the emergency dams, one of the inspectors being left in charge of the headquarters at Ambridge, Pa., to carry on the inspection work in the United States. The present inspection force on the Isthmus consists of one designing engineer, one field inspector, and two structural inspectors.

AIDS TO NAVIGATION.

This subdivision has been under the immediate charge of Mr. Walter F. Beyer, assistant engineer, assisted by Mr. Charles Stubner, supervisor in charge of the field forces, and the necessary draftsmen, clerks, etc. On April 20, 1912, Lieut. Albert H. Acher, Corps of Engineers, United States Army, was assigned to this subdivision as junior engineer.

The project for lighting and buoying the canal was outlined in the last annual report. Since then only minor changes have been made in the location of a number of lights and in renumbering the aids from the Pacific entrance of the canal to the Miraflores locks.

CLEARING, ETC.

In the general project for lighting the canal, it is necessary to have a range of two lights at each end of the longer tangents to prolong the sailing line, in order that the pilot may keep his course up to the turning point. The prolongations of these tangents on which the lights are situated are covered with heavy growths of brush and timber, and trochas had to be cut through the jungle until suitable locations were found for the lights. These trochas are the width of the canal at the beginning and narrow down to 480 feet at the end. Surveying parties ran the lines and clearing parties finished the work. Three surveying parties of 10 men each were employed and the clearing gang consisted of 60 men.

Profiles through the two lights of each range were taken and are shown on drawing 4651. (Plate 75.)

Area cleared during the year (\$22.7198 per acre) ..	acres--	809.85
Area cleared to June 30, 1912	do----	1,183.35
Trocha cut during the year	linear feet--	305,790
Trocha cut to June 30, 1912	do----	437,965
Profile taken during the year	do----	76,074
Profile taken to June 30, 1912	do----	81,274
Line run during the year	do----	92,900
Line run to June 30, 1912	do----	92,900

The positions of 60 gas buoys have been located, referenced, and checked, and three beacons in Gatun Lake section have been located.

CONSTRUCTION WORK.

The field force was organized and construction work began at the Pacific entrance September 1, 1911.

The types of towers are shown in the last annual report and plates 13 to 17 and 75 of this report. The interior stairways are of reinforced concrete, the parts being made at the central plant of the lighthouse subdivision at Balboa. Radial beams, on which the stringers rest, extend from the center newel post to the walls at heights of every 4 feet. The treads are then supported on the stringers and newel post, and mortared in, making a circular stairway in one solid piece. This design permits using treads and stringers of the same dimensions in all the conical towers in spite of the fact that the higher towers are wider at the base than the lower

ones. The only parts of the stairway which must vary in dimension to correspond to the splay of the conical surface of the tower are the radial beams.

The foundations for the towers are varied to suit the local conditions, some of the types being described below:

The rear tower of range No. 9-11, the focal plane of which is 56 feet above mean tide, is founded upon the rocks at Farfan Point, which at low tide are dry and at high tide are partly inundated. Loose rock was placed upon large boulders and outcropping bed-rock, and carefully leveled off at a height of 17 feet above low tide. Upon this rock a cellular foundation pier, 24 by 24 feet in plan and 5 feet high was constructed of reinforced concrete, the walls being 12 inches thick, thus making the deck of the pier 22 feet above low tide. The tower is built upon the deck of this pier which is supported by interior cross walls and vertical posts. The front tower is founded upon a reinforced concrete caisson which rests upon 25 bearing piles, driven through the mud flats to bedrock, about 25 feet below the surface. The butts of the wooden piles are protected with an armor of concrete from the surface of the mud flats to within about 2 feet above low tide and are capped with a concrete slab platform 12 inches thick and 26 feet square, reenforced with old T-rails and round bars. The caisson is 24 by 24 feet in plan and 15 feet high, the bottom being 12 inches thick and heavily reenforced. The deck is 6 inches thick. The lower 8 feet of the caisson was constructed on the shipways at Balboa, and after the concrete had sufficiently hardened the caisson was launched and at high tide towed out to the site. When in position it was securely moored by means of four hawsers leading to anchors previously placed, the valves at the bottom of the caisson walls were opened to allow the water to enter, and thus it was gradually sunk onto the concrete platform. Sufficient ballast rock was then placed in the caisson to keep it in position, and the remaining 7 feet of concrete walls and the deck were constructed. The bottom of the caisson is 7 feet above low tide and the deck is 22 feet above. At low tide the entire caisson is exposed. The sand around the base is protected against scour by rip-rap.

The front light of range No. 13-14, Pacific division, the focal plane of which is 56 feet above mean tide, is founded upon an octagonal foundation pier 24 feet between parallel sides and 6 feet high, resting upon 29 bearing piles driven into the alluvial soil to refusal. The piles are armored and capped in a similar manner to those of the foundation just described. The bottom of the foundation pier is 16 feet above low tide and its deck is 22 feet above. The rear tower is founded upon firm ground at the southeasterly end of Nunez Island, the foundation consisting of a concrete slab 20 inches thick, heavily reenforced.

The towers are constructed by means of steel forms, which are designed to be used for the three types of towers used in the Atlantic and Pacific section, and they consist of sections 4 feet high, of such sizes as to be easily handled by two laborers. The forms for the octagonal base are first set up and filled with concrete, after which the bottom ring of the conical portion of the tower is set up and filled, and then a second ring is set up and filled. After the concrete in the lower ring has set the forms are stripped and set up on top of

of upper ring, repeating the process until the belt course below the watch room is reached. The forms are made in segmental sections or staves, and the desired taper is given by omitting a section entirely or substituting a narrower one for it when the form is shifted to a higher position. One set of forms answers for all towers of the types used in the sea-level section, and another set for all towers of the Gatun Lake type. The forms for the watch room and lantern room are set up and filled when the body of the tower has been finished. All the work is carried on from a scaffold tower inside the tower. In this way the tower rises at the rate of 4 feet per day. Wooden forms are placed between the interior and exterior steel forms for the purpose of coring out openings for doors and windows, which openings are later trimmed with concrete architrave moldings, sills, and lintels.

The only exposed metal on the towers consists of the gallery railing, lantern door, and sash and ventilators, all of which are made of rust-resisting iron and bronze, and the cast-iron ball ventilator at the apex of the tower.

The lantern is supplied with slide ventilators by means of which circulation of air may be regulated, thus insuring a steady flame in the lantern.

The material entering into the construction of the towers in the Pacific division was loaded at Balboa upon a large lighter, which was towed to the several sites. In the case of the two submarine sites for range No. 9-11, the lighter was moored alongside the foundations and the work of construction carried on from the lighter.

The front tower of range No. 5-6, Atlantic division, is the only 74-foot tower completed, and is illustrated by plate 13.

The front tower of range No. 1-2, Gatun Lake section, is situated on the south middle wall of the Gatun locks. In order to get a foundation on the earth fill without introducing any horizontal thrust against the two retaining walls, which, with the back fill, make up the middle wall of the lock, it was necessary to build two reenforced concrete beams with a span of 38 feet, extending from the second step on one wall to the second step on the other wall. On these beams were built four pillars 20 by 24 inches in plan, extending above the top of the lock walls and capped by a platform whose elevation is 15 feet above the coping, spanning the return track of the towing locomotive with a clearance of 13 feet, sufficient for the locomotive. A concrete stairway leads to this platform and the platform has a concrete railing. The tower is the regular 28-foot type, illustrated on plate 14.

Work has been begun on the Gatun Lake towers, which are to be built when the lake is at elevation of 27 feet to 55 feet. Material is hauled on lighters by a steam launch to the nearest landing point, where it is unloaded, mixed, and carried up to the tower by a small cableway. The two lighters for this work were built by this subdivision at an improvised boatway near Gatun. The cableway was made from various parts secured from other construction divisions.

The plans for the tower of the west breakwater light are shown on plate 76. This is to be a harbor light with a compressed air fog signal and submarine bell. It is made of reenforced concrete throughout, with hollow tile lining to prevent moisture. The interior is to be equipped with engines, compressors, a water supply and drainage system, and quarters for the attendants complete. The foundation

is to be a large pile of rip-rap surmounted by a reenforced concrete caisson 46 by 46 feet in plan by 35 feet high. This caisson is now being built in the Mount Hope dry dock and is completed up to a height of 13 feet. After this is completed and seasoned, it will be floated out to position and sunk by letting water into the 16 compartments through valves placed in the outside walls for that purpose. The outside pockets will then be ballasted with rock and the remainder of the caisson completed. After it has settled sufficiently the superstructure will be built. The above is illustrated on plate 76.

Eleven of the towers have been completed to date as follows: Nos. 5 and 6, Atlantic division; Nos. 2, 9, 11, 13, and 14, Pacific division; Nos. 1, 21, 24, and 25, Gatun Lake section.

CENTRAL PLANT.

A central plant was established at Balboa in December, 1911, for casting concrete units, making wooden forms, etc. Up to June 30, 1912, this plant has cast 56 beacons, 55 beacon roofs, 90 stair stringers, 597 stair treads, 101 radial beams, 82 architrave moldings, 48 window lintels, 46 window sills, 68 sinkers for gas buoys, 60 sinkers for spar buoys, and 2 beacon foundations for Pacific division type of beacon, illustrated on plate 77. These small caisson foundations are built on shipways and will be floated out to position and placed on concrete piles.

ILLUMINANTS.

The illuminants will be gas and electricity, the latter being used wherever the light is sufficiently accessible. For the floating buoys and for the 23 towers and beacons, which are in inaccessible places, the system using compressed acetylene dissolved in acetone has been adopted.

Two temporary acetylene gas outfits have been installed in the towers of range No. 9-11, Pacific division, two oil lamps in the towers of range No. 13-14, Pacific division, and two electric lamps in the towers of range No. 5-6, Atlantic division, all of which are used by the dredging fleets and by ships entering the terminal ports.

White lights will be used throughout, and in order to eliminate the possibility of conflicting the lights with one another and with the lights on shore, all range lights, beacons, and buoys will have individual characteristics formed by flashes and combinations of flashes of light and dark intervals.

Drawings and specifications for the gas buoys were made and prices asked from the companies furnishing the system required. Tenders were opened on June 21, 1912, but the award had not been made at the end of the fiscal year.

Such buoys as will be required are composed of a cylindrical floating body or tank, surmounted by a steel frame which supports the lens at a height of about 15 feet above water level. The body is about 8 feet in diameter, to the bottom of which is attached a counterweight of suitable size to maintain the lantern frame in an upright position at all times. The buoys will be moored in position along the edge of the dredged channel by a heavy chain and a concrete sinker, and should remain lighted from 6 to 12 months without being recharged.

The candlepower of the range lights will vary, according to the length of the range, from about 2,500 to 15,000 candlepower. The most powerful lights will be those marking the sea channels at the Atlantic and Pacific entrances, they being visible from about 12.5 to 18 nautical miles. The beacons and gas buoy lights will have about 950 candlepower.

A lamp shifter has been designed and a trial one is being made. It will be used on electric lights to place automatically a new globe in focus if the lighted one burns out.

During the year 51 tracing were made with their drawings and various studies and sketches.

CONTRACTS.

Exhibit 1, attached, is a list of contracts which have been let on specifications prepared in this division.

Respectfully, H. F. HODGES,
Colonel, Corps of Engineers, U. S. Army,
Assistant Chief Engineer.

Col. GEORGE W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

EXHIBIT 1.

Status of contracts for work under charge of first division of chief engineer's office as of June 30, 1912.

Circular.	Contractor.	Material.	Price.	Per cent completed.
513	United Engine & Foundry Co.	Anchorages for lock gates.....	\$528,124.70	100
	Rosedale Foundry & Machine Co.	Cylindrical valves.....	84,177.50	100
	Chapman Valve Co.....	By-pass valves.....	4,339.80	100
	Crane Co.....	do.....	6,456.00	100
	Lynch Bros. Foundry Co.....	do.....	9,114.90	100
	Penn Bridge Co.....	Ladder rungs.....	2,058.40	100
	United Engine & Foundry Co.	Snubbing hooks, girders, etc.....	46,846.56	100
515	Penn Bridge Co.....	Fixed irons for rising stem gate valves and 2 valves.....	29,252.56	100
552	Wheeling Mold & Foundry Co.	Fixed irons for rising stem gate valves.....	199,106.24	100
576	McClintic-Marshall Co.....	Mitering lock gates.....	5,374,474.00	¹ 76
594	Wheeling Mold & Foundry Co.	Fixed irons for rising stem gate valves.....	225,895.61	100
	Rosedale Foundry & Machine Co.	Cylindrical valves.....	140,588.00	100
	Pennsylvania Steel Co.....	Snubbing hooks and girders.....	17,216.94	100
614	Wheeling Mold & Foundry Co.	2 rising stem gate valve machines.....	15,299.00	100
	do.....	114 rising stem gate valve machines.....	651,877.88	14
	do.....	Spare parts.....	11,072.50	1
	do.....	2 cylindrical valve machines.....	2,264.00	100
	do.....	118 cylindrical valve machines.....	102,258.09	25
	do.....	Spare parts.....	2,064.70	0
	do.....	12 auxiliary culvert valve machines.....	11,103.84	25
	General Electric Co.	4 motors for rising stem valve machines.....	2,780.00	100
	Westinghouse Electric & Manufacturing Co.	2 motors for rising stem valve machines.....	4,454.00	100
	Allis-Chalmers Co.....	do.....	3,200.00	100
	General Electric Co.....	114 motors for rising stem valve machines.....	75,644.70	0
	do.....	4 motors for cylinder valve machines.....	1,355.00	100
	Westinghouse Electric & Manufacturing Co.	2 motors for cylinder valve machines.....	3,822.00	100
	Allis-Chalmers Co.....	do.....	2,610.00	100

¹ Delivery only.

Status of contracts for work under charge of first division of chief engineer's office as of June 30, 1912—Continued.

Circular.	Contractor.	Material.	Price.	Per cent completed.
	General Electric Co.....	118 motors for cylinder valve machines.	\$41,636.30	0
	do.....	12 motors for auxiliary culvert valve machine.	4,234.20	0
	do.....	2 lt. sw. for rising stem valve machines.	196.00	100
	Westinghouse Electric & Manufacturing Co.....	do.....	225.00	100
	Cutler-Hammer Manufacturing Co.....	do.....	98.00	100
	do.....	114 lt. sw. for rising stem valve machines.	5,586.00	22
	General Electric Co.....	2 lt. sw. for cylinder valve machines...	196.00	100
	Westinghouse Electric & Manufacturing Co.....	do.....	225.00	100
	Cutler-Hammer Manufacturing Co.....	do.....	98.00	100
	do.....	118 lt. sw. for cylinder valve machines.	5,782.00	21
616	United States Steel Products Co.	6 emergency dams, complete.....	2,243,068.38	1 53
619	do.....	Steel cross-ties, tie clips, conductor slot covers, conductor rails, channels, etc.	135,318.71	95
	R. C. Hoffman Co.....	Rack and miscellaneous castings.....	250,367.17	44
	Ross-Meehan Foundry Co.....	Malleable iron cover plates, etc.....	17,678.16	91
	Westinghouse Electric & Manufacturing Co.....	Porcelain insulators.....	5,858.76	13
	Oliver Iron & Steel Co.....	Steel bolts, lead for gaskets, coil springs, etc.	12,054.08	100
	Chicago Railway & Traction Supply Co.	Bumping posts.....	2,632.50	100
620	United States Steel Products Co.	Lock gate recess covers.....	130,000.00	100
627	Wheeling Mold & Foundry Co.	2 miter gate moving machines.....	16,270.00	100
	do.....	90 miter gate moving machines.....	653,422.50	0
	do.....	Spare parts.....	7,670.56	0
	Richard Manufacturing Co.....	1 miter forcing machine.....	1,150.00	100
	do. ²	45 miter forcing machine.....	28,205.00	0
	do. ²	Spare parts.....	1,920.50	0
	General Electric Co.....	2 motors for gate moving machine.....	1,134.40	0
	Allis-Chalmers Co.....	do.....	3,000.00	100
	General Electric Co.....	90 motors for gate moving machine.....	45,288.00	0
	do.....	1 motor for miter forcing machine.....	339.00	100
	do. ²	45 motors for miter forcing machine.....	13,230.00	0
628	(³).....	Track material.....	7,236.57	65
635	(³).....	Steel rail.....	67,402.50	60
636	McClintic-Marshall Co.....	Spillway gates, caissons, footbridges etc.	103,686.94	75
	do.....	Rising stem gate valves, guard gate valves, lateral culvert valves, bulk-head gates and screens.	238,994.94	60
	Excelsior Tool & Machine Co..	Fixed irons for spillways.....	25,724.12	100
	Westinghouse Machine Co.....	Roller trains, sealing vices, rocker bearings, rollers, etc.	177,147.58	50
	Vulcan Rail & Construction Co.	Railings for spillways.....	5,665.00	100
636D	St. Louis Screw Co.....	Brass bolts, nuts, etc.....	24,772.05	100
639	U. S. Steel Products Co.....	Deckings and intake bridges.....	21,414.97	100
644	J. B. Kendal Co.....	Bars for deckings.....	1,059.35	100
645	Shawmut Clay Manufacturing Co. ⁴	Vitrified tile, mandrels, etc.....	85,350.00	.....
647	Wheeling Mold & Foundry Co.	Copper conductor rail and bars.....	168,423.04	100
647A	Clinton Wire Cloth Co.....	Reinforcing grids.....	560.00	100
	Sneath Glass Co.....	Vault lights.....	2,325.00	100
648	Pelton Water Wheel Co.....	Penstocks.....	24,530.00	60
	do.....	Turbines, governors, headgates, etc.....	70,012.50	0
	General Electric Co.....	Generators, exciters, etc.....	54,599.00	0
	Niles-Bement-Pond Co.....	Traveling crane.....	7,445.00	0
649	United Engine & Foundry Co.	Fender chains.....	428,005.00	0
650	General Electric Co.....	1 trial towing locomotive.....	24,951.00	0
	do. ²	39 towing locomotives.....	498,016.35	0
656	Standard Foundry & Machine Co.	Snubbing posts, etc.....	5,518.09	100
	American Car & Foundry Co..	Bolts, links, eyes, etc.....	6,257.02	100
	Railway Spring Co.....	Helical springs.....	13,572.24	75
661	Stacy-Schmidt Manufacturing Co.	Spillway gate machine and spares.....	70,542.04	0
	H. R. Worthington.....	Pumps.....	821.25	0

¹ Delivery only.

² Contract let conditionally.

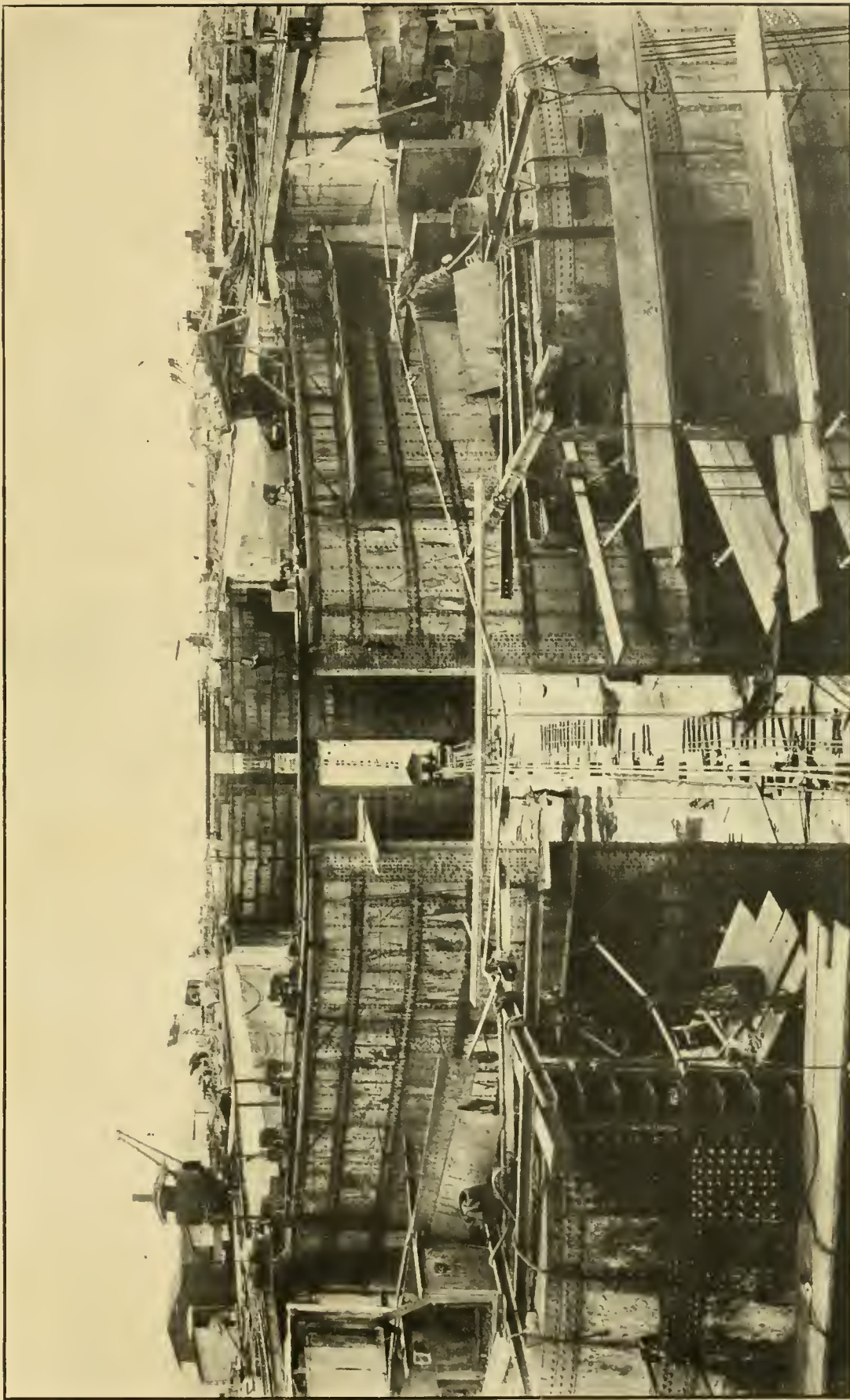
³ Supplied through Quartermaster's Department on stock requisition.

⁴ Being received and installed by construction divisions.

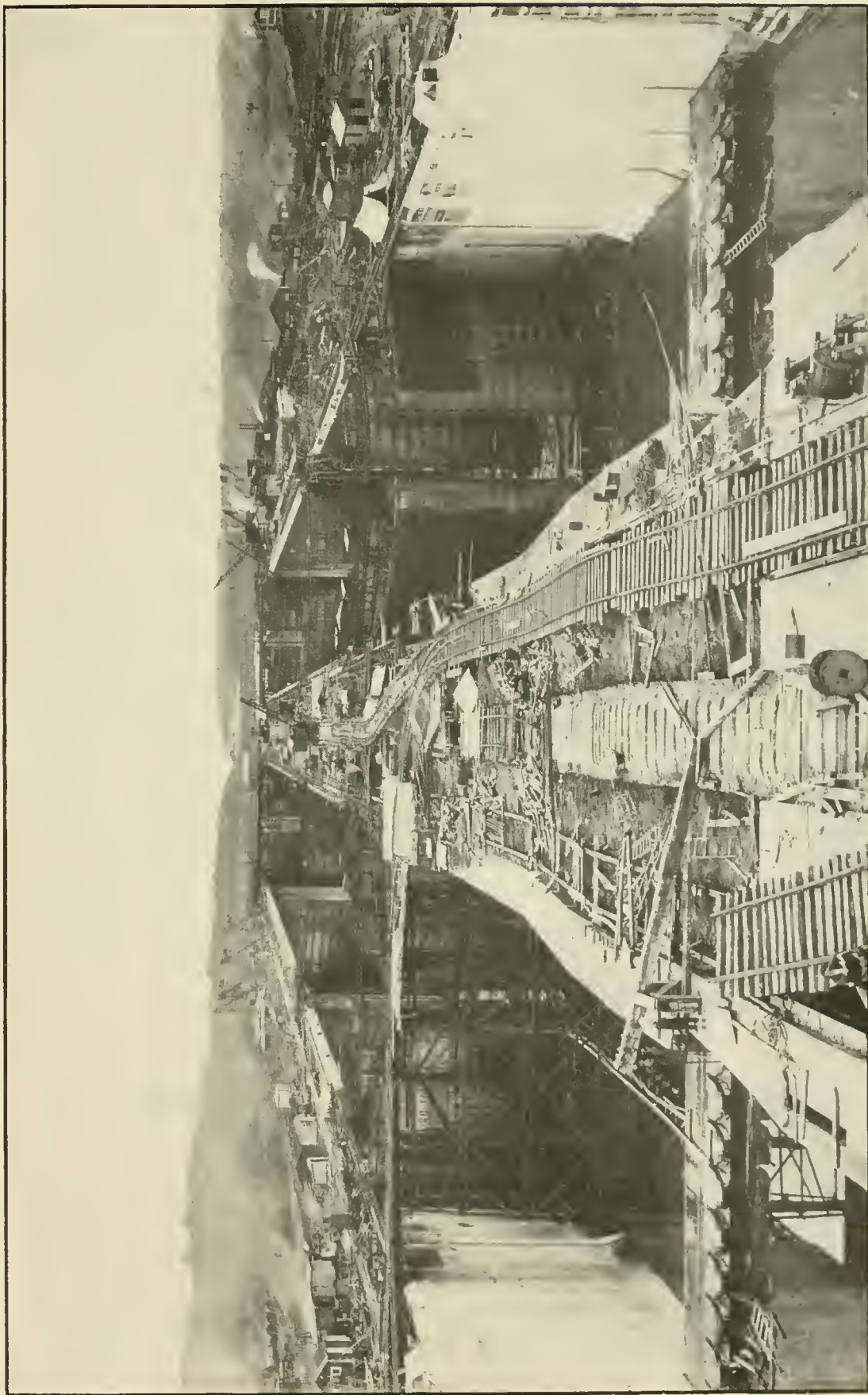
Status of contracts for work under charge of first division of chief engineer's office as of June 30, 1912—Continued.

Circular.	Contractor.	Material.	Price.	Per cent completed.
662	Industrial Works.....	Cranes, hooks and lines.....	\$63,000.00	100
665	American Steel & Wire Co.....	Triangular mesh reinforcement.....	891.44	100
666	U. S. Steel Products Co.....	Cross-bonds, punches, riveting hammers, copper cable, etc.	2,014.83	100
	National Electric Supply Co..	Galvanized conduit, pipe couplings, bushings, locknuts, etc.	2,055.10	50
	Pennsylvania Flexible Metal Tubing Co.	Flexible conduit and couplings.....	4,466.00	0
	Chas. A. Schieren Co.....	Leather gaskets.....	42.00	100
	O. A. Danzenbaker.....	Asbestos pads.....	75.60	100
	Detroit Screw Works.....	Brass pins.....	117.00	100
	R. C. Hoffman Manufacturing Co.	Steel splice bars.....	568.82	100
667	Standard Foundry Co.....	Crank gear recess cover seats.....	30,421.64	32
679	General Electric Co.....	Starting panels, limit switches, commutating switches, etc., indicators for control machinery, switchboards and control switch boards, starting panels for chain-fender.	172,653.70	0
	Union Switch & Signal Co....	Indicating devices.....	450.00	0
681	General Electric Co.....	Motors.....	110,260.18	0
	General Electric Co. (Cameron)	Pumps.....	26,921.50	0
	General Electric Co.....	Float switches and starters.....	13,882.20	0
	Alberger Pump Co.....	Pumps.....	21,860.78	0
	Earle Gear & Machinery Co...	Handrail gearings.....	5,360.00	0
688	U. S. Steel Products Co.....	Crossovers and turnouts.....	44,142.00	0
695	General Electric Co.....	Insulated cable.....	132,028.60	0
705	.....	Transformer room equipment (bids opened May 22, but no award made to June 30).	.....	.....
715	.....	Auxiliary electrical equipment for Gatun hydroelectric station (bids to be opened July 8).	.....	.....
W. O. 27626	McClintic-Marshall Co.....	Erection of lock gate recess covers, purchased under Circular 620.	30,000.00	70
	.....	Miscellaneous articles and equipment to be used in connection with erection of machinery, etc.; contracts with numerous companies, the total amounting to about.	14,000.00	.....
	Total.....	.....	13,993,589.08	.....

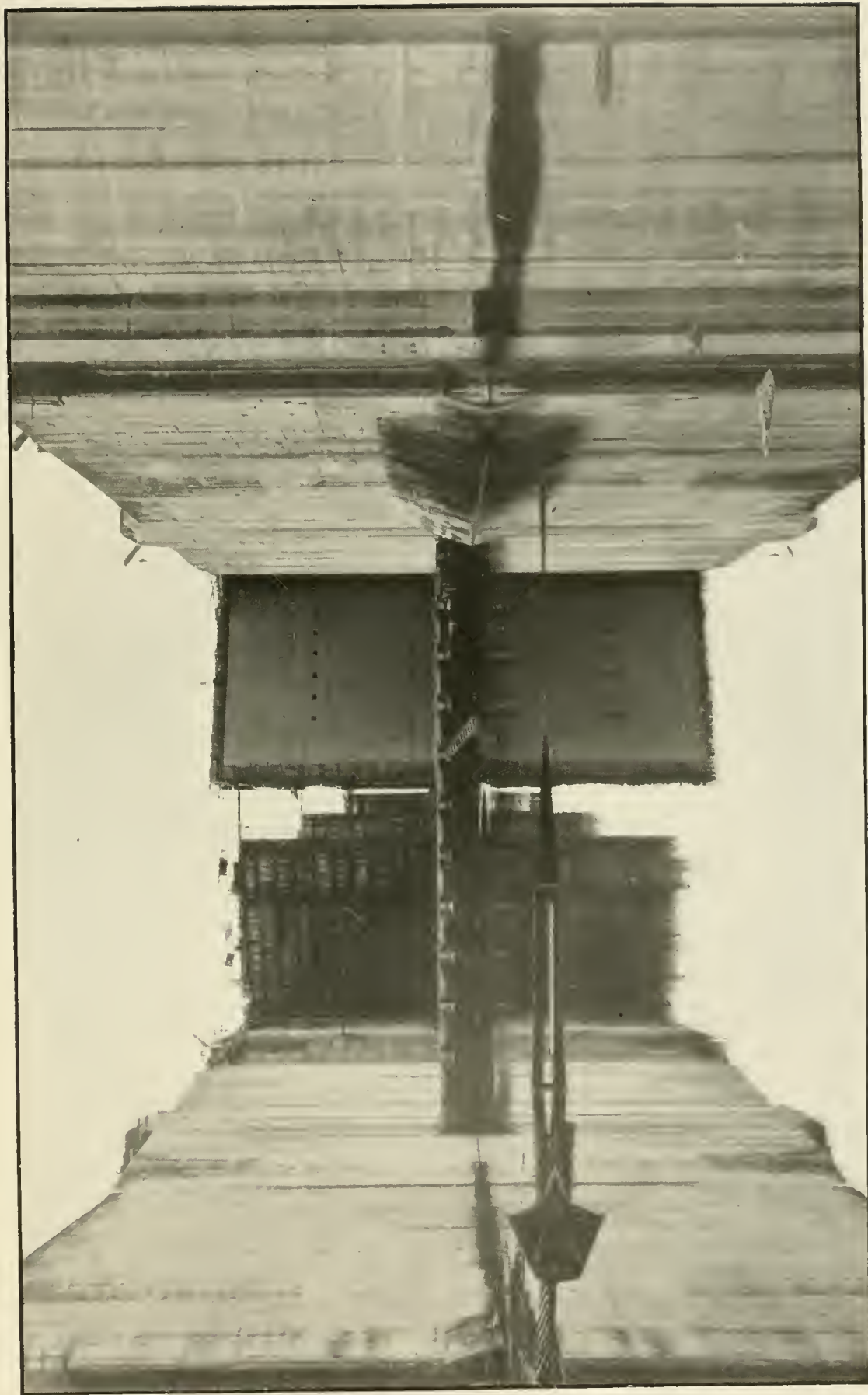
PLATE 1.



GATUN UPPER LOCKS, WEST CHAMBER LOOKING NORTH, SHOWING UPPER GUARD GATES, OPERATING GATES, INTERMEDIATE GATES, AND SAFETY GATES IN PROCESS OF CONSTRUCTION. JUNE 7, 1912.

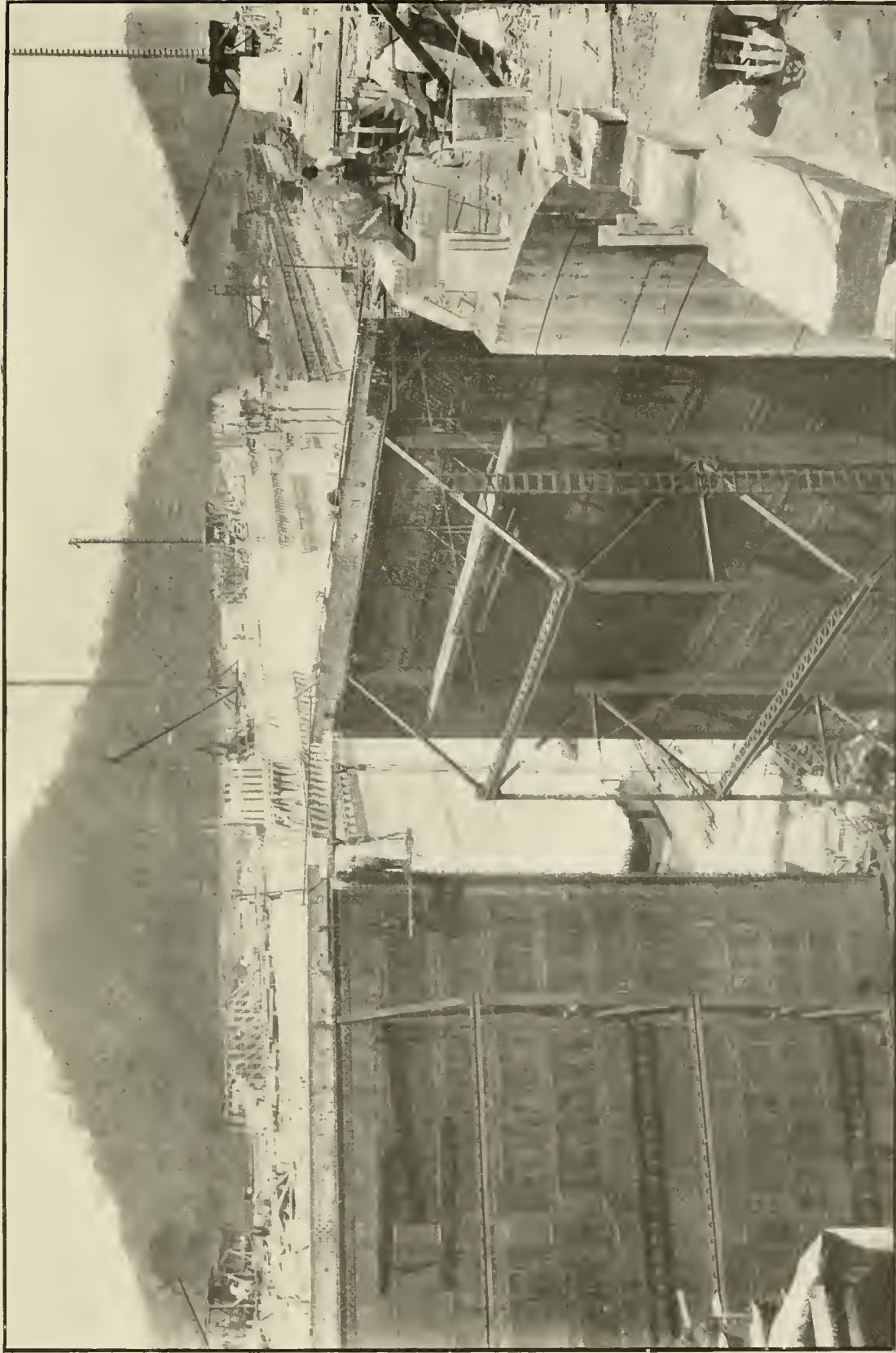


GATUN UPPER LOCKS LOOKING NORTH FROM LIGHTHOUSE. JULY 2, 1912.

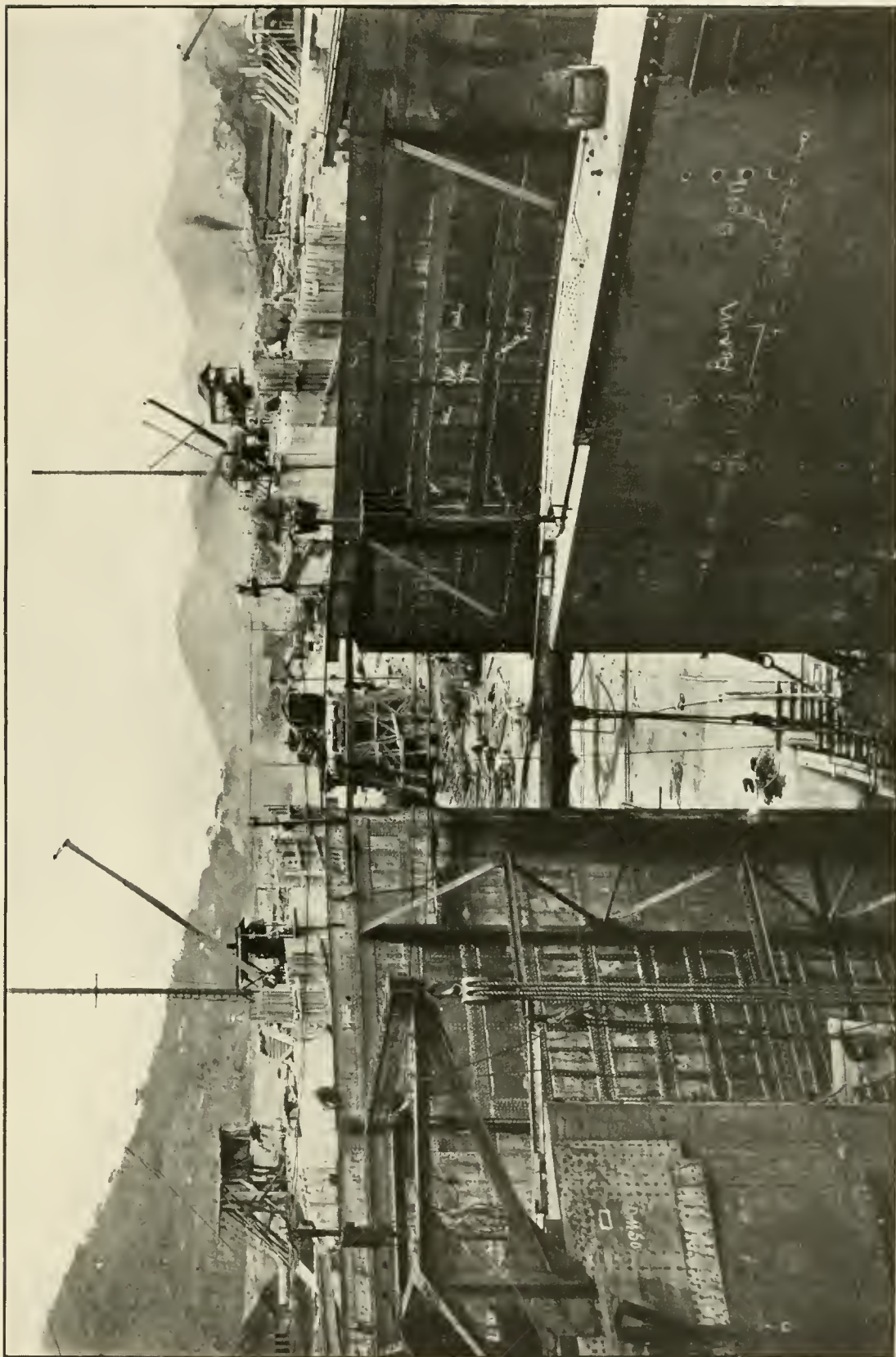


GATUN UPPER LOCKS, EAST CHAMBER, LOOKING NORTH FROM FOREBAY, SHOWING UPPER GUARD GATES AND EMERGENCY DAM SILL. JULY 7, 1912.

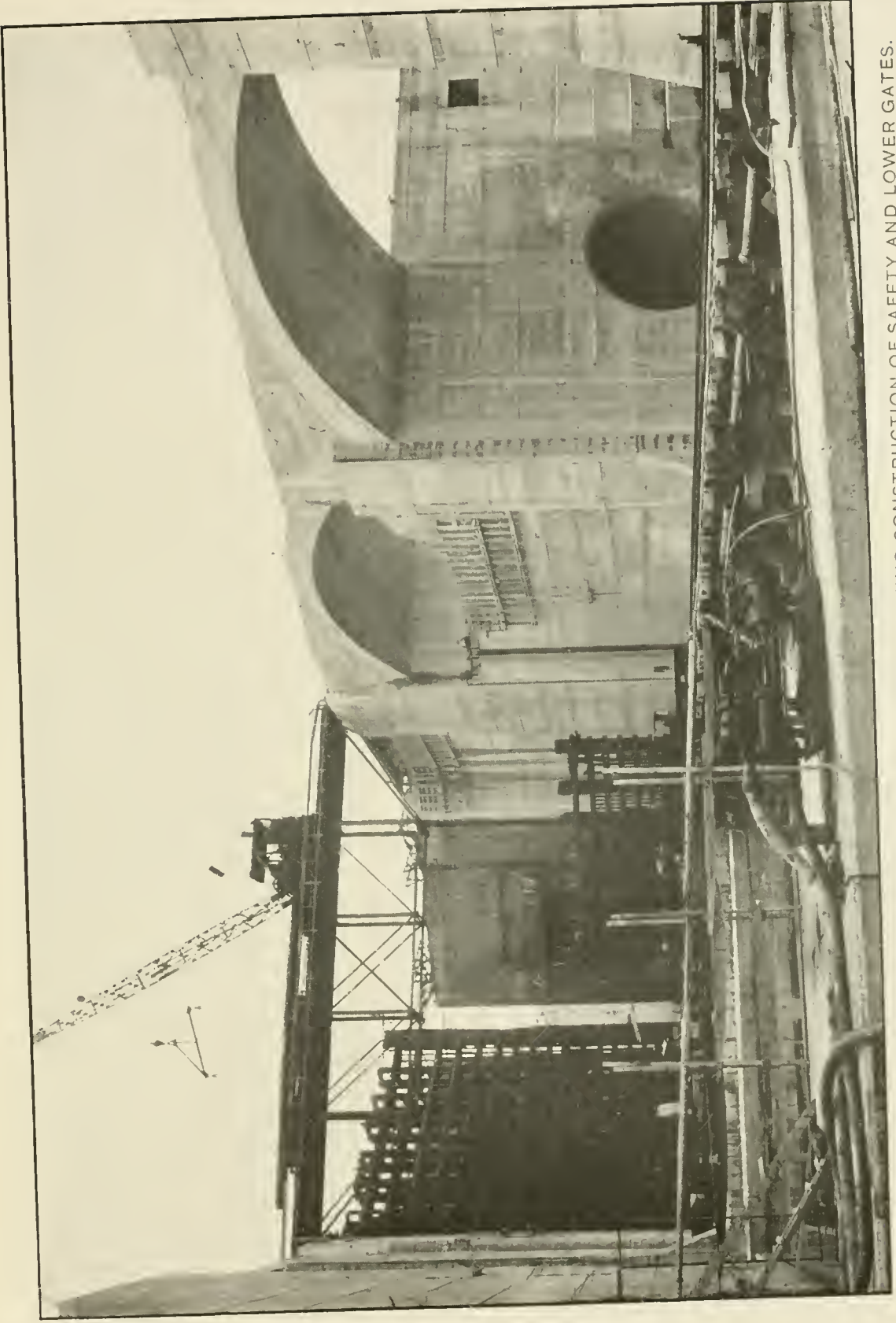
PLATE 4.



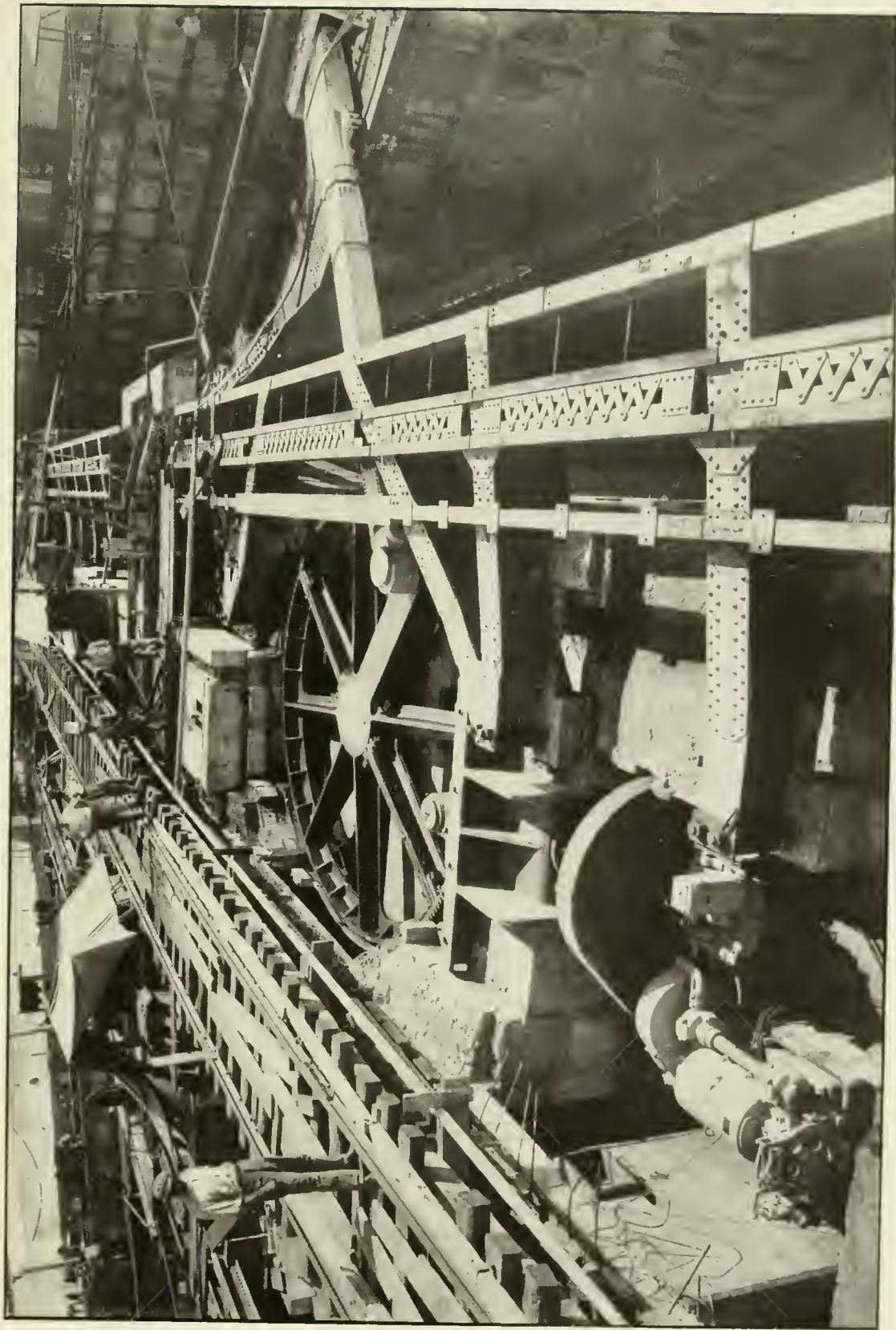
PEDRO MIGUEL LOCKS LOOKING NORTH, SHOWING UPPER GUARD GATES, EAST CHAMBER FOREBAY, AND CONSTRUCTION OF APPROACH WALL. MARCH 28, 1912.



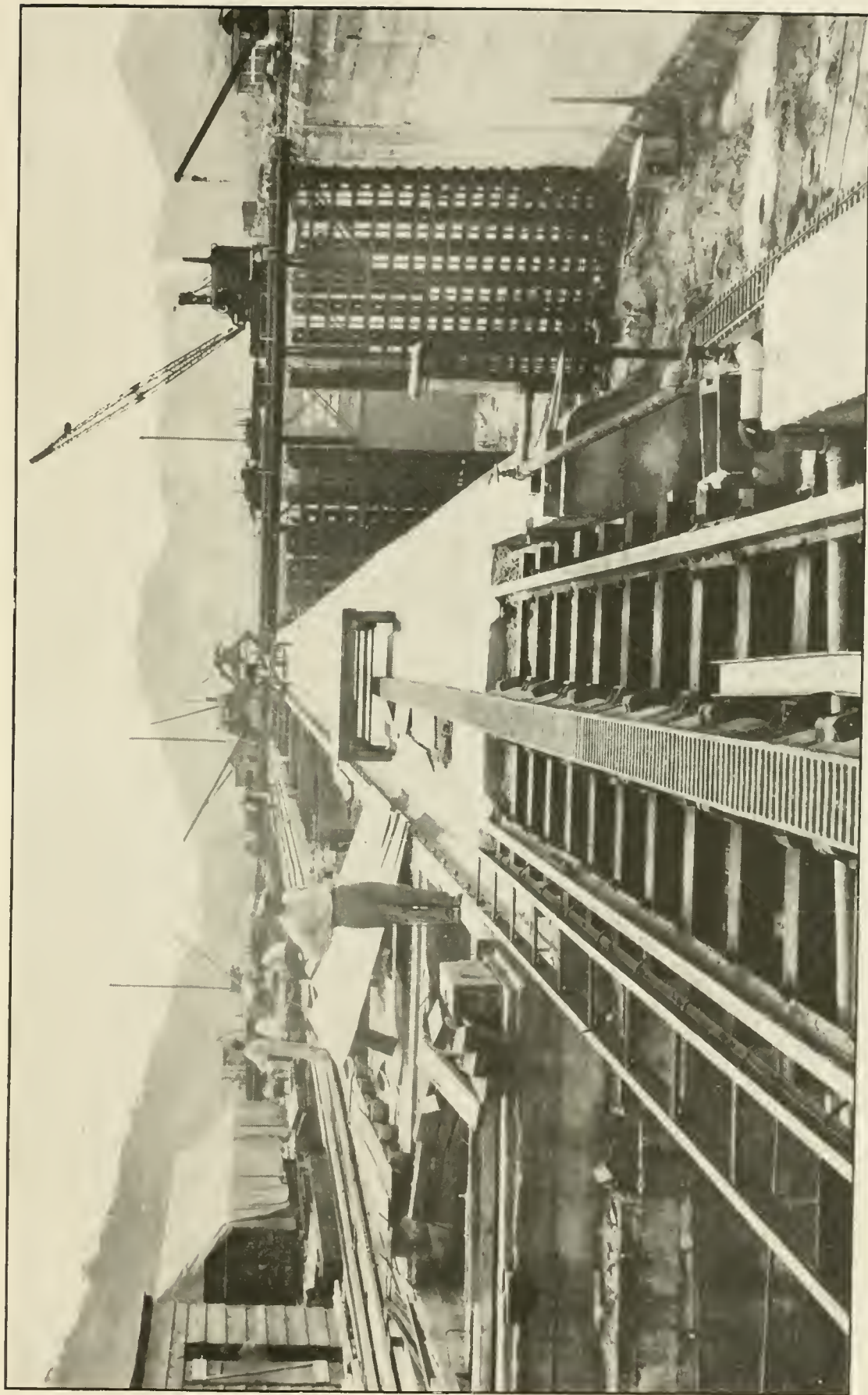
PEDRO MIGUEL LOCKS, NORTH END OF WEST CHAMBER, SHOWING CONSTRUCTION OF UPPER GUARD GATES AND UPPER GATES. JUNE 5, 1912.



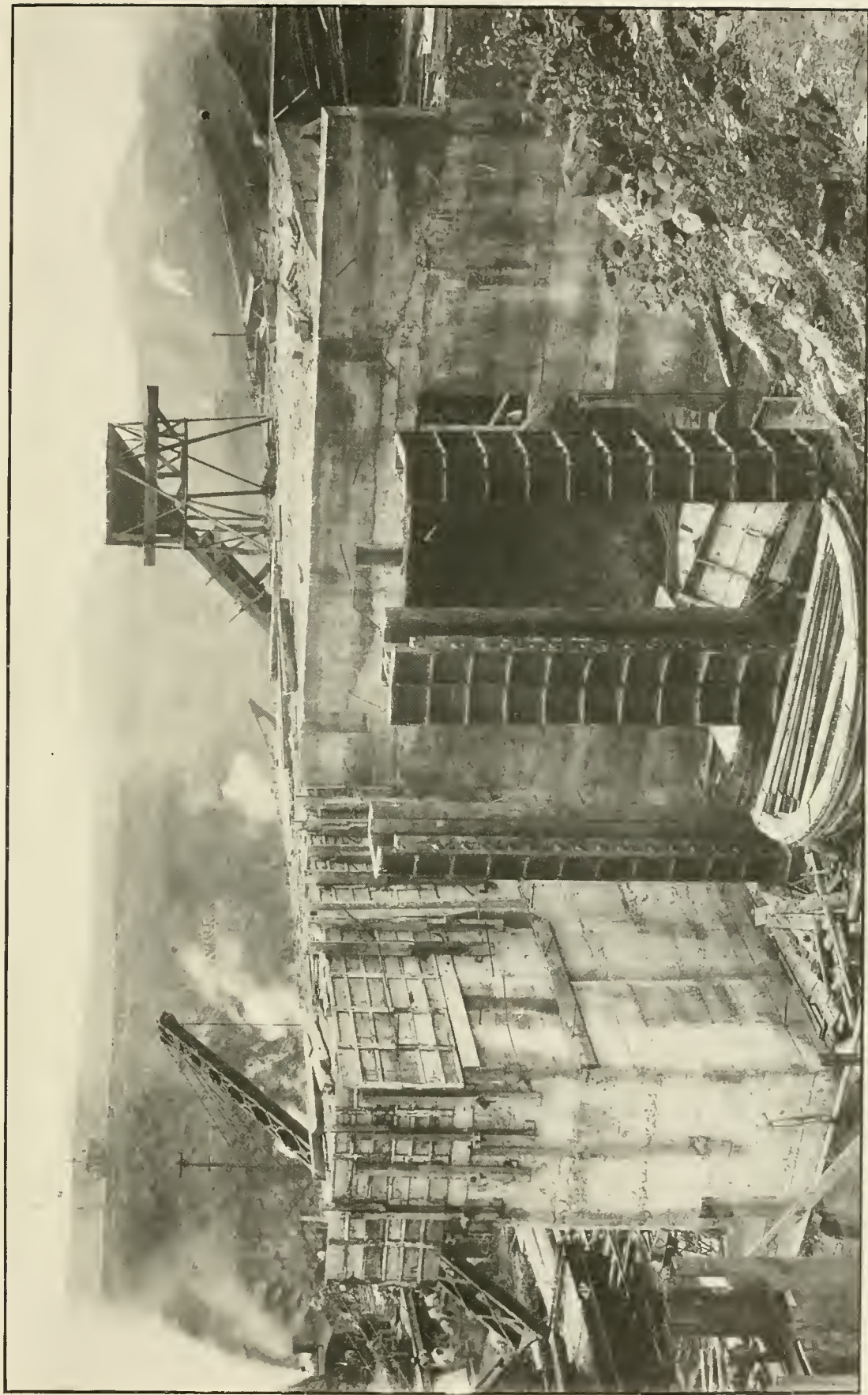
PEDRO MIGUEL LOCKS, SOUTH END OF EAST CHAMBER, SHOWING CONSTRUCTION OF SAFETY AND LOWER GATES.
JUNE 3, 1912.



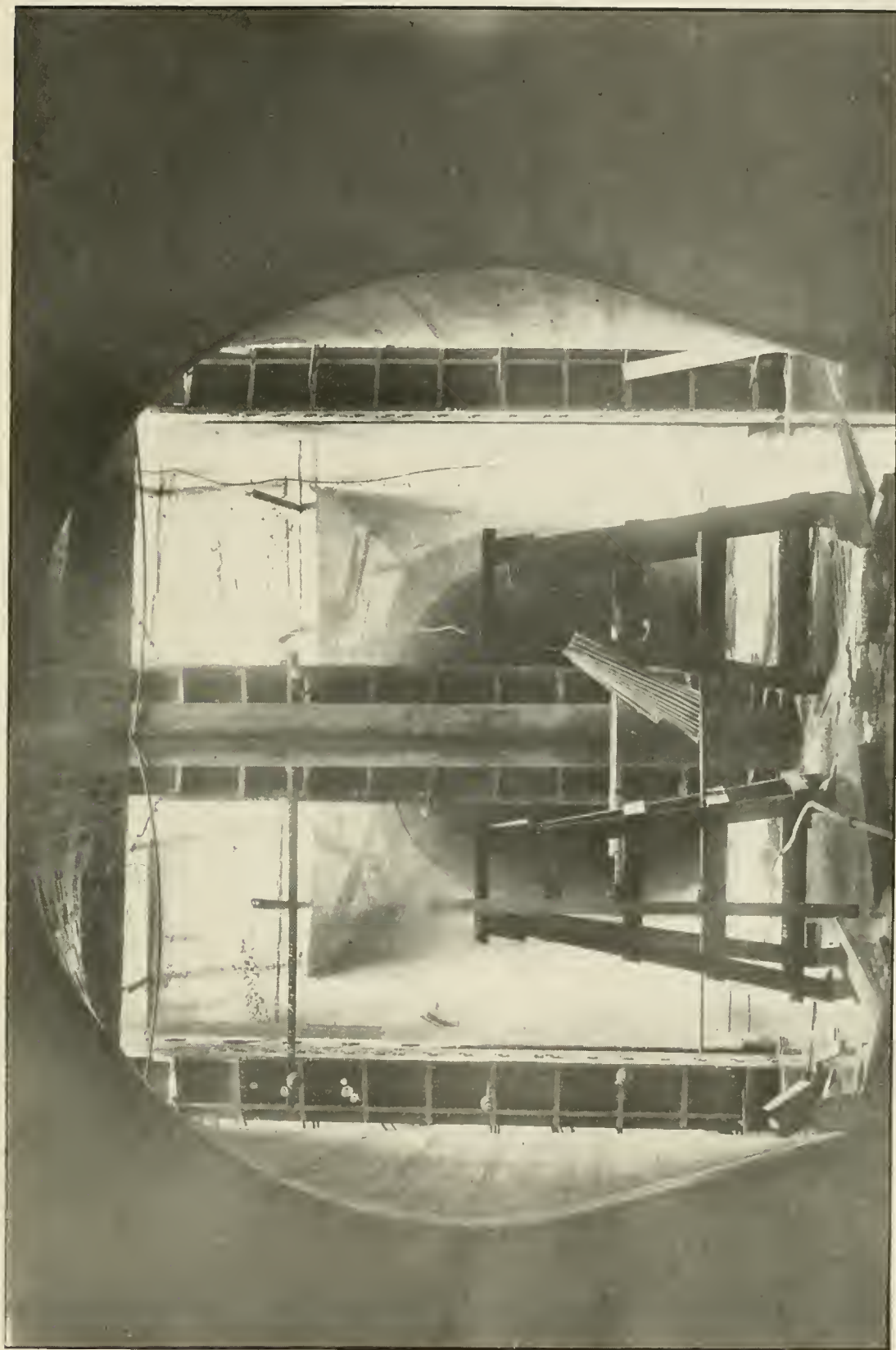
GATUN UPPER LOCKS, MITER GATE MOVING MACHINE, STRUCTURAL STEEL GIRDERS FOR TOWING LOCOMOTIVE
TRACK SUPPORTS IN FOREGROUND. JUNE, 1912.



PEDRO MIGUEL LOCKS, DETAIL OF CONSTRUCTION OF ELECTRIC TOWING LOCOMOTIVE RACK TRACK. JUNE, 1912.

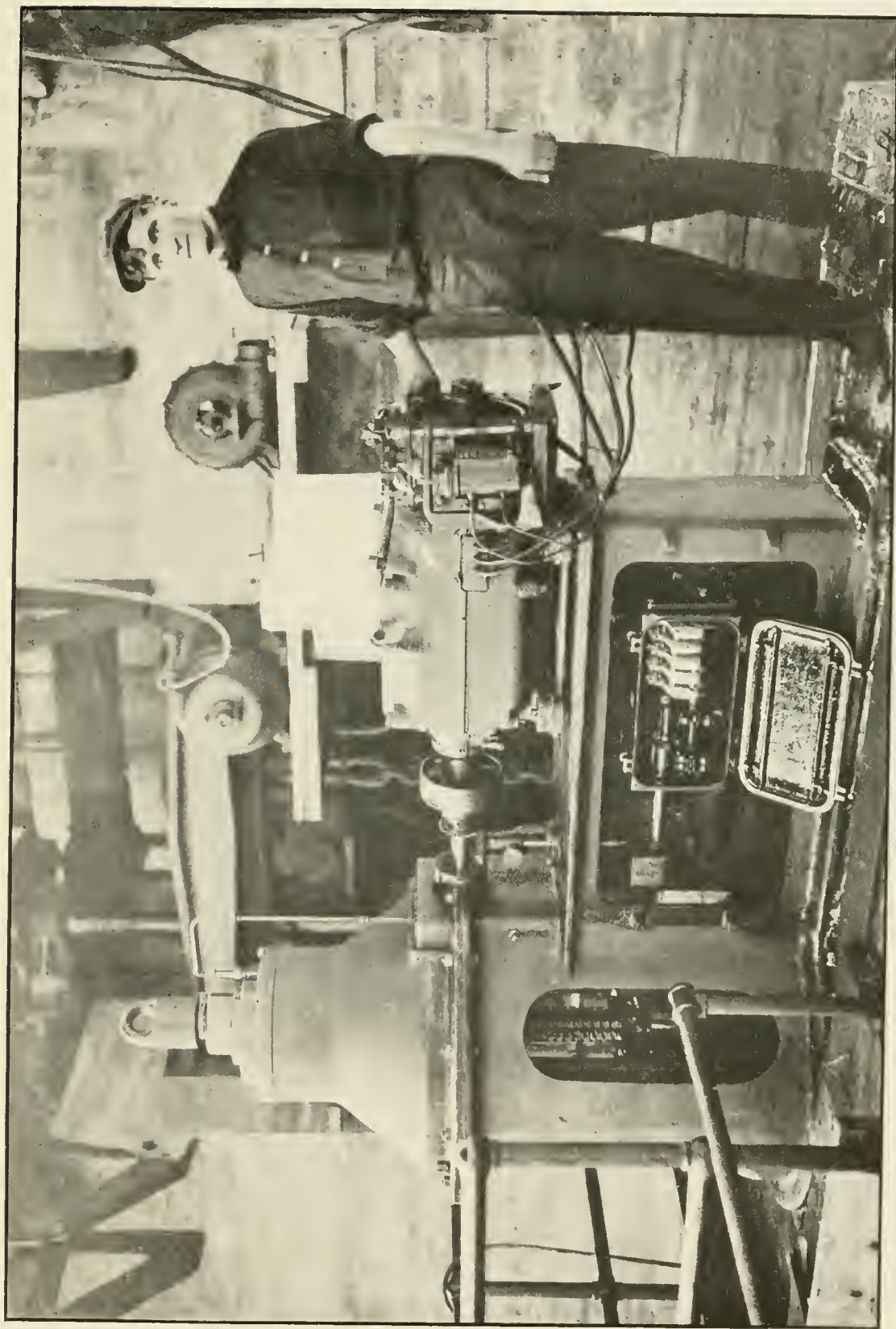


MIRAFLORES UPPER LOCKS, SHOWING STONEY GATE VALVE FRAMES IN POSITION IN SOUTH END OF WEST WALL.
NOVEMBER 8, 1911.

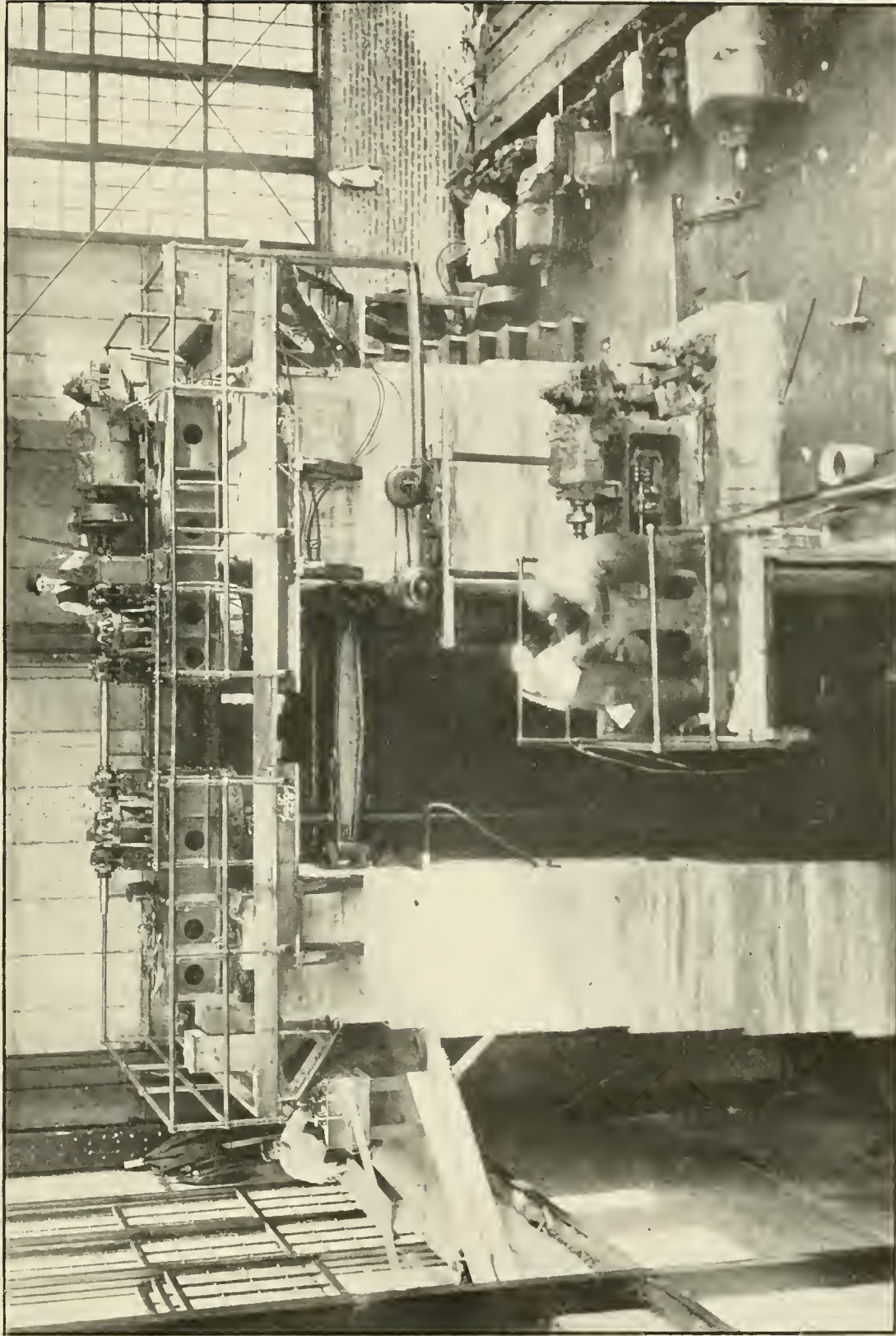


MIRAFLORES UPPER LOCKS, CENTER WALL CULVERT, SHOWING STONEY GATE CASTINGS IN PLACE. JUNE 23, 1912.

PLATE 11.



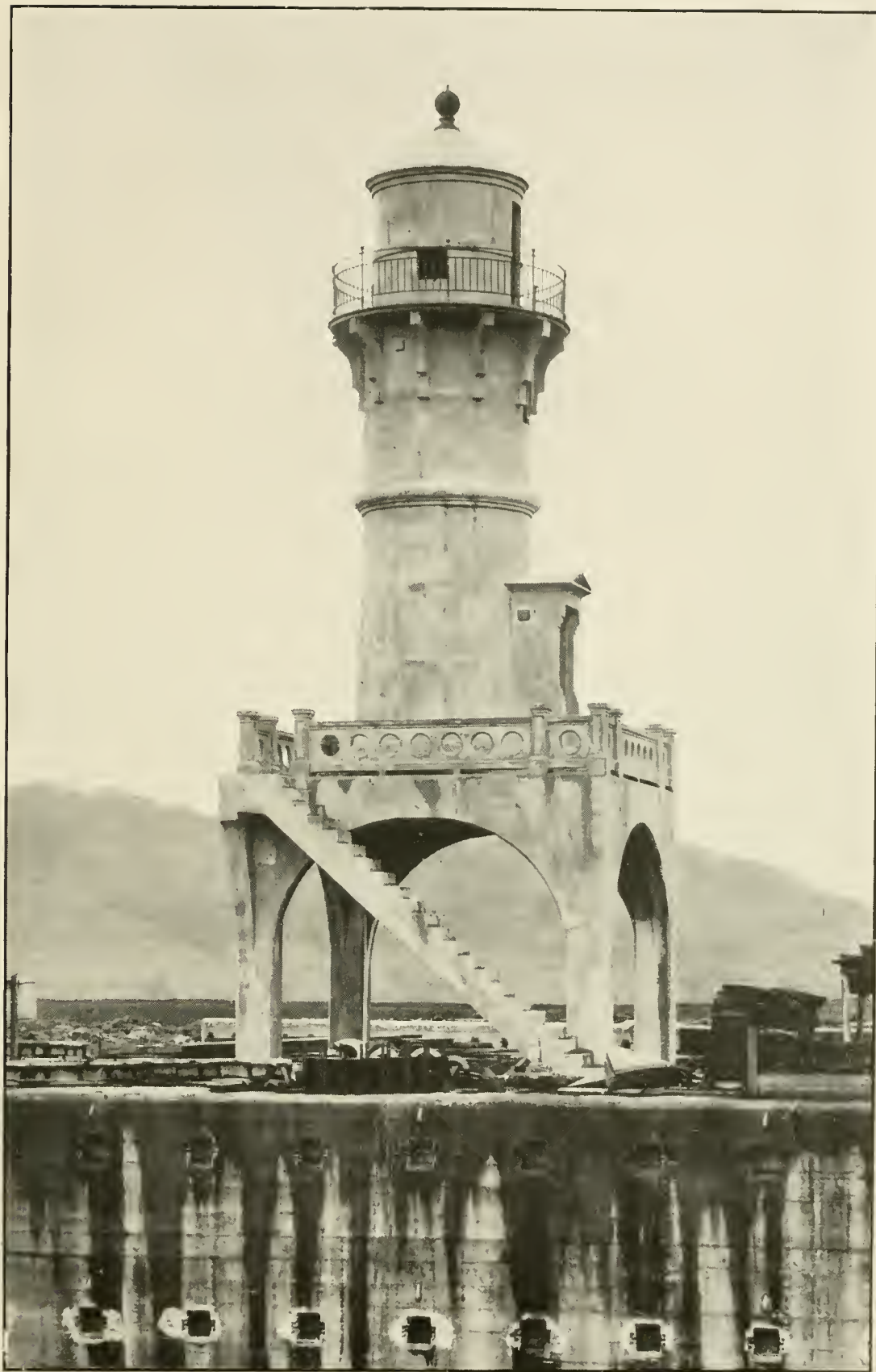
CYLINDRICAL VALVE MACHINE, MOTOR, AND LIMIT SWITCH.



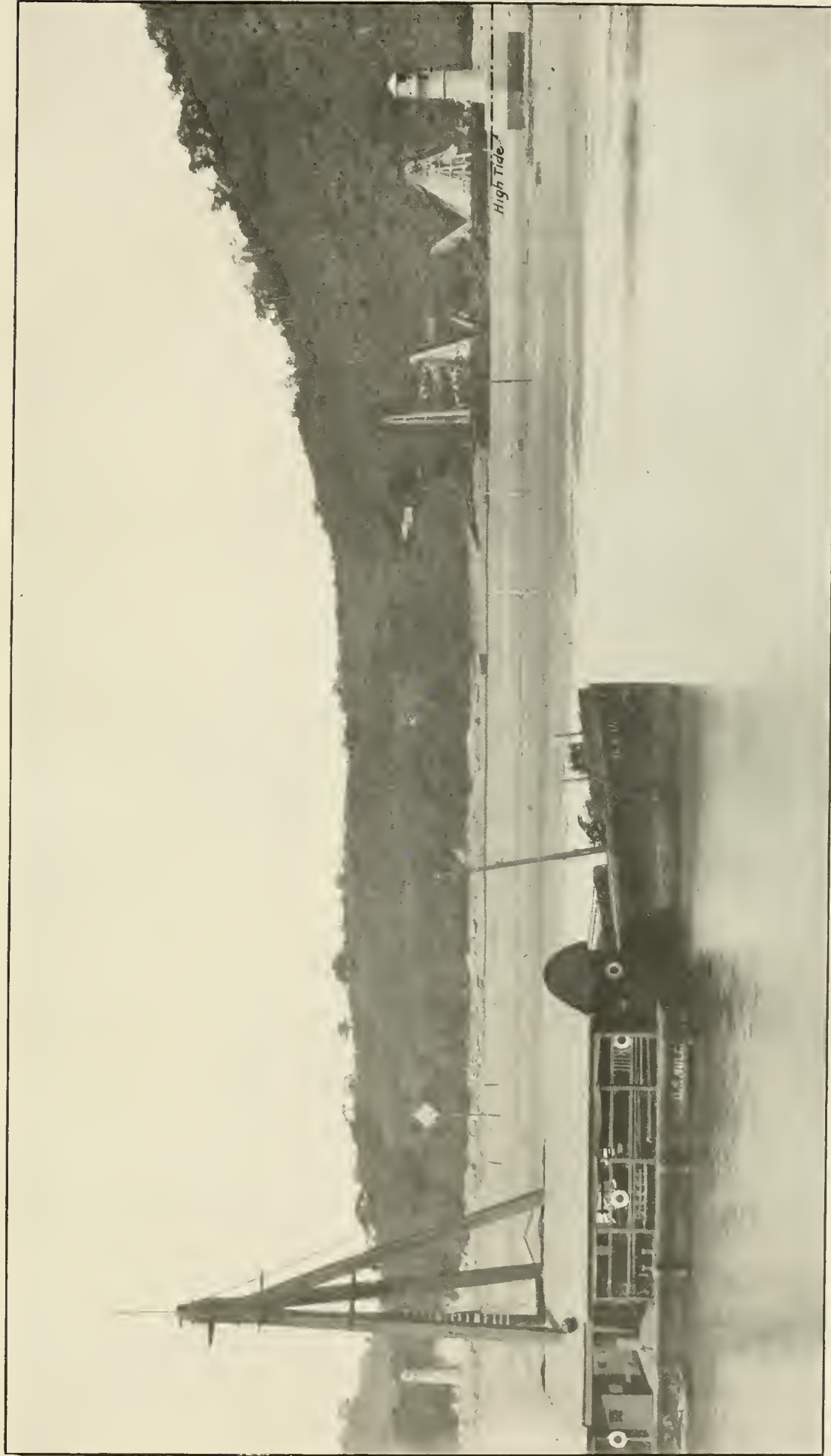
RISEING STEM GATE VALVE MACHINE.



FRONT TOWER, RANGE 5-6, ATLANTIC DIVISION.



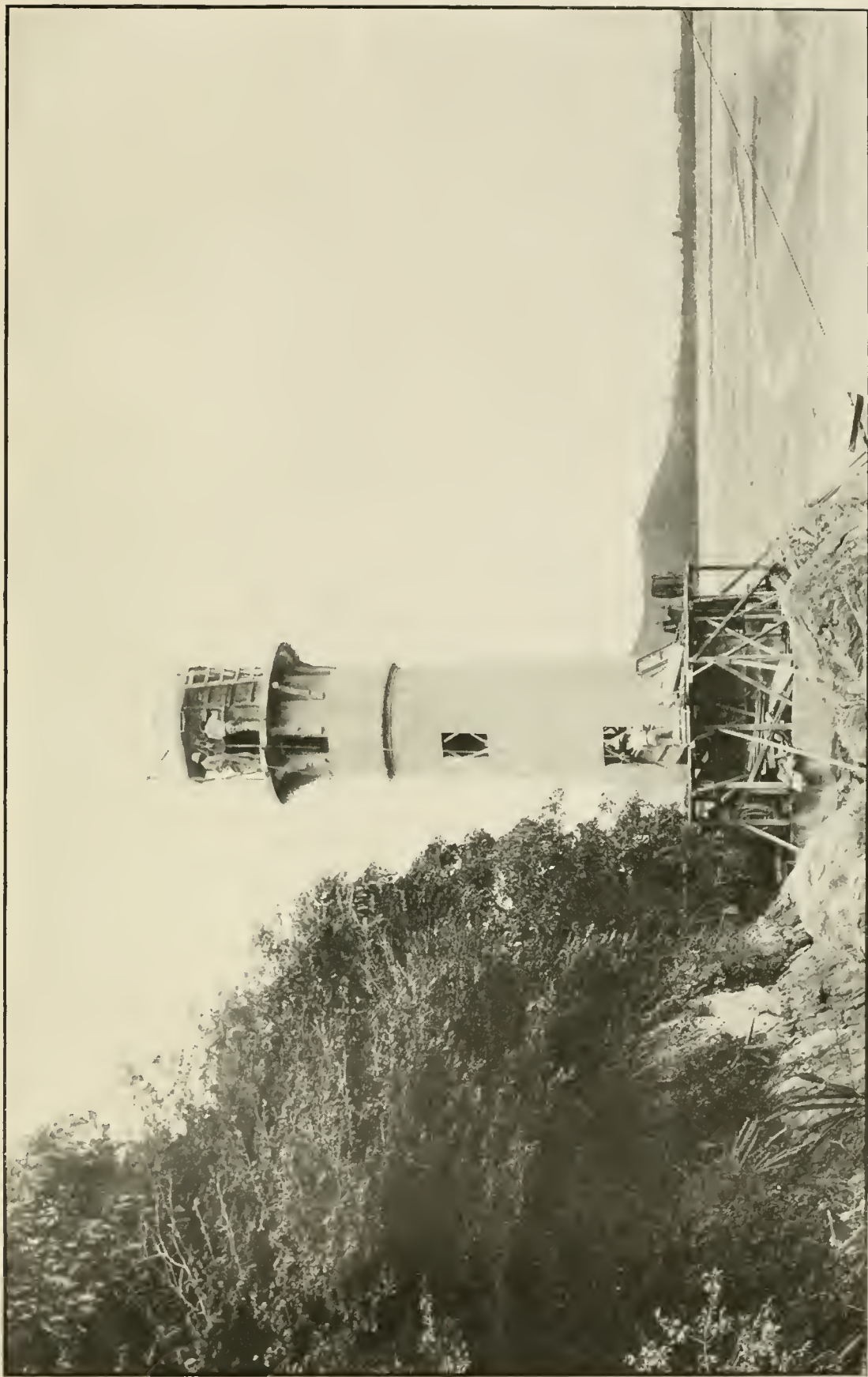
FRONT TOWER, RANGE 1-2, GATUN LAKE SECTION, ON SOUTH MIDDLE
APPROACH WALL OF GATUN LOCKS.



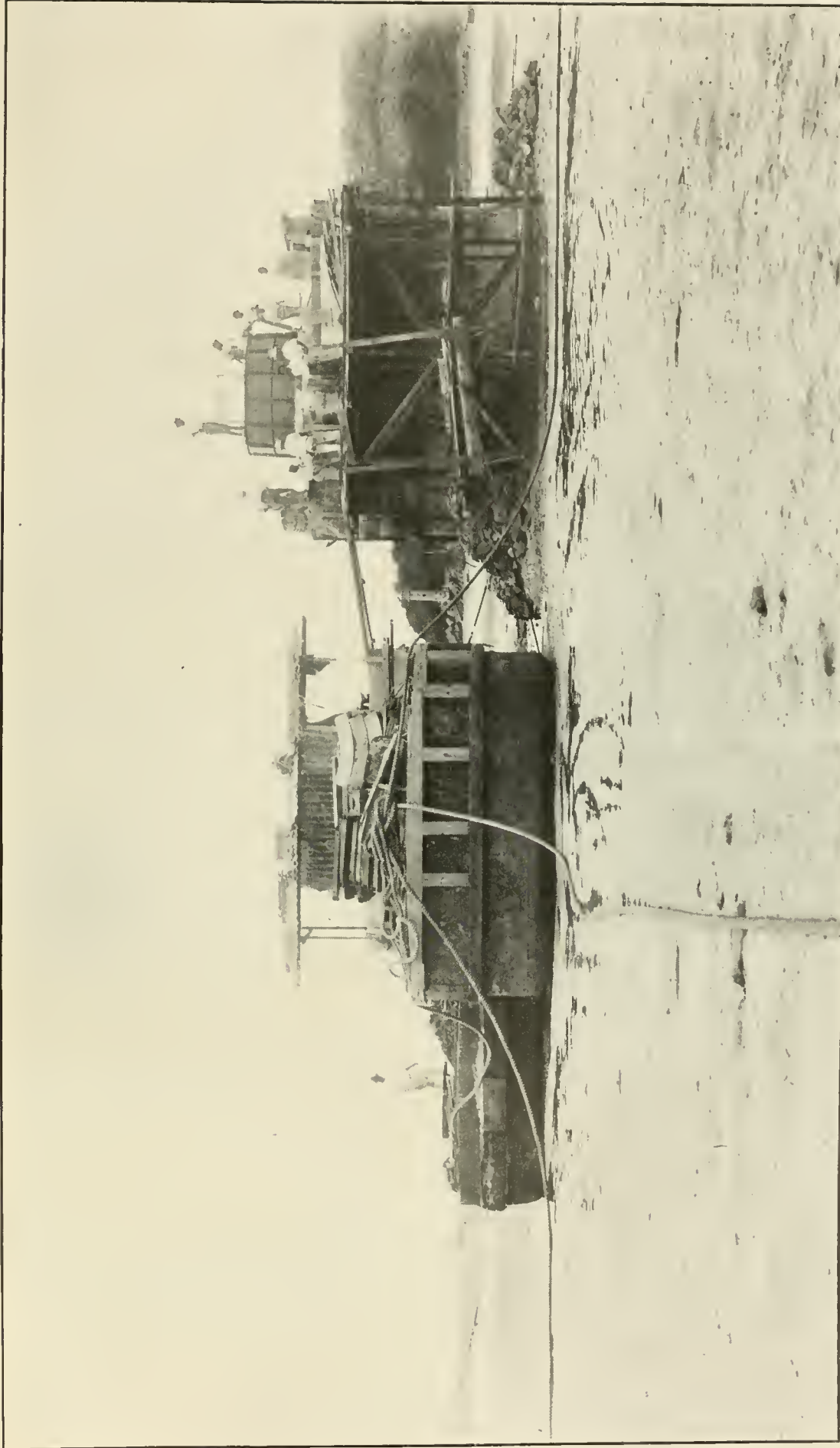
Rear tower.

RANGE 3-4. (9-11) PACIFIC ENTRANCE AT LOW TIDE.

Front tower.



REAR TOWER, RANGE 9-11, PACIFIC ENTRANCE LOOKING NORTHWEST. NOVEMBER 7, 1911.



FRONT TOWER, RANGE 9-11, PACIFIC ENTRANCE LOOKING SOUTHEAST. NOVEMBER 7, 1911.



REINFORCED CONCRETE STAIRWAY IN ATLANTIC AND PACIFIC DIVISION TYPE
OF RANGE TOWERS.

APPENDIX B.

REPORT OF LIEUT. COL. WILLIAM L. SIBERT, CORPS OF ENGINEERS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, DIVISION ENGINEER, ATLANTIC DIVISION.

ISTHMIAN CANAL COMMISSION,
DEPARTMENT OF CONSTRUCTION AND ENGINEERING,
ATLANTIC DIVISION,
OFFICE OF DIVISION ENGINEER,
Gatun, Canal Zone, July 31, 1912.

SIR: I have the honor to submit the following report of work done by the Atlantic division, department of construction and engineering, during the fiscal year ending June 30, 1912:

The work assigned to the division remains as described in the report for the fiscal year ending June 30, 1910.

The construction work comprised within the division, as shown on the accompanying drawing, 12-14-34 (Plate 78), is divided into four parts, as follows:

First. That comprising the excavation of the channel between the Gatun locks and the Atlantic Ocean; the procuring and transporting of stone and sand from Porto Bello and Nombre de Dios, respectively, to Gatun; the transportation of cement from Cristobal to Gatun; the operation of the dry dock and shops at Cristobal; and the construction of the breakwater in Colon Harbor. Maj. Chester Harding, Corps of Engineers, United States Army, assistant division engineer, in local charge.

Second. That comprising the construction of the Gatun locks. Maj. James P. Jervoy, Corps of Engineers, United States Army, resident engineer, in local charge.

Third. That comprising the construction of the Gatun dam and spillway. Maj. George M. Hoffman, Corps of Engineers, United States Army, resident engineer, in local charge.

Fourth. That comprising municipal engineering work. Mr. Leslie G. Thom, superintendent, in local charge until December 13, 1911. Mr. George M. Wells, office engineer, in local charge from December 14, 1911, until June 30, 1912.

DIVISION OFFICE.

The usual clerical duties were performed in connection with miscellaneous correspondence, reports, cost accounting, pay rolls, and other routine papers.

DIVISION DESIGNING FORCE.

[Mr. George M. Wells, office engineer, in local charge.]

The following is a summary of the work done by the division designing force during the fiscal year:

Preparation of drawings to accompany the annual report of the Division Engineer for the fiscal year 1911-12.

Design and details of temporary bulkheads for the main culverts at the north end of the locks.

Details of quadrant foundation for the emergency dam.

Detailed design and specifications for two 116-foot deck Pratt railroad bridges across the locks.

Studies for railroad trestle and approaches crossing the locks.

Design and details for the north approach wall.

Design and details of forms and method of constructing the north approach wall.

Design and details of arch center for the arches at the north end of the locks.

Design and details for permanent oil and water lines crossing the locks at the north end.

Detailed plans of drainage for the back fill at the south end of the locks.

Layout of suggested parapet back fill for the Fortification Board.

Design and details of rock and sand unloading trestle at Mindi.

Design and details of the dynamite unloading wharf at Mindi.

Design and details of 42-foot removable steel deck railway span.

Computations and drawing of moment diagrams for standard rolling stock.

Design and details of automatic regulator for the sedimentation basin of the Agua Clara waterworks.

Location and design of tunnel and headworks between the Gatun Lake and the Brazos Brook Reservoir.

Studies, design, and details for proposed new waterworks and filtration plant for Colon.

Experiments and detailed designs for aerating nozzles for the Colon waterworks.

Design and details of standard reenforced concrete highway bridge across Mount Hope-Gatun Road.

Studies for annex to the Cristobal commissary.

Design and details for two 15-ton derrick barges for the Colon Breakwater.

Design and details covering the modification of Bucyrus pile driver for Colon Breakwater.

Design and details of swinging cantilever sounding bridge for Colon Breakwater.

Details of rearrangement of cutter machinery of 18-inch pipe line dredge No. 4.

Design and details of steel spud.

Details of proposed manganese steel, five-yard dipper.

Details of high-pressure cylinder for the tug *Mariner*.

General drawings of new hull for the tug *Grace*.

Design and details of boat davits for the dredge *Caribbean*.

Design and details for the modification of 70-ton steam shovel, equipping it with 60-foot boom for 15-ton rock on the breakwater face.

General detailed drawings of spare and repair parts for division plant and equipment.

During the year approximately 8,000 prints were made.

CHANNEL EXCAVATION FROM GATUN TO THE ATLANTIC OCEAN, COLON BREAKWATER, AND SAND, STONE, AND CEMENT SERVICE FOR GATUN LOCKS AND SPILLWAY, FOR THE YEAR ENDING JUNE 30, 1911.

[Maj. Chester Harding, Corps of Engineers, U. S. Army, assistant division engineer, in local charge.]

EXCAVATION BELOW SEA LEVEL—MINDI.

[See plate 78.]

During the year two 70-ton shovels removed 56,703 cubic yards of earth and 368,169 cubic yards of rock, an average of 30,348 cubic yards per shovel month. In addition, 1,000 cubic yards of mud were sluiced from the cut. The dry excavation was completed on February 24, 1912.

In blasting the Mindi barrier 183,150 pounds of dynamite were used, 81,750 lineal feet of drilling done, and 258,310 cubic yards of rock blasted.

The amount of material removed monthly is shown in the following table:

Canal prism.

	Earth.	Rock.	Total.	Remarks.
1911.	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	
July.....	4,190	54,935	59,125	Includes 1,000 cubic yards sluiced.
August.....	20,728	44,313	65,041	
September.....	17,609	56,878	74,487	No material was excavated outside of the canal prism.
October.....	6,570	59,349	65,919	
November.....	3,590	51,129	54,719	
December.....		50,199	50,199	
1912.				
January.....	450	32,715	33,165	
February.....	4,566	18,651	23,217	
March.....				
April.....				
May.....				
June.....				
Total.....	57,703	368,169	425,872	

The average division cost per cubic yard at Mindi was 0.5999.

About 350,000 cubic yards of rock from Mindi were used at Gatun for back fill, the cost of dumping being charged to the locks.

Upon the completion of steam-shovel excavation the pit was flooded by blasting a shallow trench through the rock at the south end of the barrier.

LEVEE FOR RETAINING HYDRAULIC FILL NEAR MINDI, EAST OF PANAMA RAILROAD RELOCATED LINE.

The levee built during the preceding year was raised wherever necessary and extended about 1,093 feet across a low area near the Mindi River, the fill being rock from Mindi cut and red clay from Gatun.

OTHER CONSTRUCTION AT MINDI.

A trestle with apron for use in loading into barges sand and crushed rock for fortification work at Toro Point was built, a wharf 130 by 32 feet for the Quartermaster's Department for unloading dynamite completed, and two levees constructed west of the French Canal and south of the Mindi hills, to be used later for retaining spoil from the suction dredges working between Mindi and Gatun.

DREDGING—OCEAN TO MINDI.

Dredges removed 3,859,445 cubic yards of earth and 495,595 cubic yards of rock from the canal prism. This work was done by the seagoing dredge *Caribbean*, 5-yard dipper dredges *Chagres* and *Mindi*, and the French ladder dredges *No. 1* and *No. 5*. Channel silting during the year was about 3,036,000 cubic yards, making the net earth excavation for the year 823,445 cubic yards.

No dredging was done on miles 1 and 2 during the year. Surveys in June, 1911, and June, 1912, showed the following distribution of the silting between dates of surveys:

	Cubic yards.
Miles 1 and 2-----	105, 631
Mile 3-----	840, 732
Mile 4-----	940, 913
Mile 5-----	992, 001

On July 1, 1911, 40 feet of water could be carried from zero to mile 0 plus 2,200 feet; 37 feet to mile 2 plus 00 feet; 40 feet to mile 3 plus 500 feet; 29 feet to mile 4 plus 500 feet; 23 feet to mile 4 plus 3,200 feet; 30 feet to mile 5 plus 2,000 feet; 22 feet to mile 5 plus 2,438.5 feet P. I.

On July 1, 1912, 40 feet of water could be carried from zero to mile 0 plus 2,200 feet; 37 feet to mile 1 plus 4,200 feet; 35 feet to mile 4 plus 3,050 feet; 30 feet to mile 4 plus 3,150 feet; 25 feet to mile 5 plus 5,100 feet; and 20 feet to mile 5 plus 5,200 feet, the south end of Mindi cut.

The efforts made to raise dredge *No. 6*, which sank in the canal prism on June 19, 1911, being unsuccessful, she was broken up by dynamiting and removed in pieces.

DREDGING—MINDI TO GATUN.

Dredges *No. 4* and *Sandpiper* removed 515,787 cubic yards of earth from the canal prism between Mindi and the old Panama Railroad line. These dredges also removed 808,676 cubic yards of earth and 75,242 cubic yards of rock excavating for the wing and approach walls at the north end of the Gatun Locks.

The average division cost per cubic yard, place measurement, for all material dredged in the prism during the fiscal year was 25.8 cents.

CRISTOBAL TERMINALS.

Forty-nine thousand five hundred and fifty-two cubic yards of earth and 71,430 cubic yards of rock were removed from the channel in front of Piers Nos. 11, 16, and 17.

MISCELLANEOUS DREDGING.

In addition to the above, 3,762 cubic yards of earth were removed from the dry-dock slip, 72,798 cubic yards of earth from the east diversion at Gatun, 23,496 cubic yards of earth and 872 cubic yards of rock from the east diversion at Mount Hope, 4,767 cubic yards of earth and 2,181 cubic yards of rock in front of the dynamite dock at Mindi, 80,293 cubic yards of earth from pit for rock dump north of Gatun Locks, 2,785 cubic yards of earth from in front of the fortification trestle at Mindi, and 2,450 cubic yards of earth from the slip at the cableways.

The total monthly output for all dredges is shown in the following table:

[Cubic yards.]

	From canal prism.			From accessory works.			Grand total.
	Earth.	Rock.	Total.	Earth.	Rock.	Total.	
1911.							
July.....	399,470	24,725	424,195	124,949	.....	124,949	549,144
August.....	324,156	43,300	367,456	4,989	.....	4,989	372,445
September.....	380,894	39,540	420,434	39,867	.....	39,867	460,301
October.....	432,653	37,747	470,400	.....	.....	.....	470,400
November.....	703,262	38,980	742,242	9,685	.....	9,685	751,927
December.....	484,024	49,385	533,409	81,977	.....	81,977	615,386
1912.							
January.....	495,340	24,888	520,228	52,779	.....	52,779	573,007
February.....	540,471	40,928	581,399	47,005	872	47,877	629,276
March.....	380,645	47,981	428,626	3,296	2,181	5,477	434,103
April.....	327,076	76,540	403,616	.....	6,291	6,291	409,907
May.....	357,066	73,090	430,156	5,297	35,328	40,625	470,781
June.....	358,851	73,733	432,584	.....	29,811	29,811	462,395
Total.....	5,183,908	570,837	5,754,745	369,844	74,483	444,327	6,199,072

The following table shows the output in the prism by months during the year and the division cost of excavation per cubic yard by the different types of dredges:

Month.	Seagoing suction dredge.		Dipper dredges.			
	Earth.	Cost per cubic yard.	Earth.	Rock.	Total.	Cost per cubic yard.
1911.	<i>Cubic yds.</i>		<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>	
July.....	298,778	\$0.0449	24,176	12,941	37,117	\$0.8842
August.....	265,542	.0454	20,519	20,183	40,702	.7145
September.....	293,621	.0365	38,052	22,457	60,509	.4657
October.....	121,440	.2091	43,057	20,534	63,591	.4625
November.....	301,201	.0366	44,609	20,968	65,577	.4052
December.....	291,669	.0412	29,953	32,179	62,132	.3755
1912.						
January.....	294,120	.0419	30,084	11,885	41,969	.5616
February.....	210,786	.0571	34,512	15,212	49,724	.4766
March.....	40,033	.7409	23,969	20,298	44,267	.6679
April.....	137,256	.1290	27,763	46,435	74,198	.5627
May.....	247,835	.0596	4,733	18,375	23,108	.7069
June.....	252,974	.0542	1,441	31,332	32,773	.7672
Total.....	2,755,255	.....	322,868	272,799	595,667	.....
Average cost.....	.....	.0671	.....	.....	.....	.5531
Plant arbitrary.....	.....	.0522	.....	.....	.....	.0522
Total division cost.....	.....	.1193	.....	.....	.....	.6053

Month.	Ladder dredges.				Pipe-line dredges.			
	Earth.	Rock.	Total.	Cost per cubic yard.	Earth.	Rock.	Total.	Cost per cubic yard.
1911.	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>		<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>	
July.....	76,516	11,784	88,300	\$0.4912				
August.....	38,095	23,117	61,212	.4882				
September.....	49,221	17,083	66,304	.4005				
October.....	89,818	17,213	107,031	.2615	178,338		178,338	\$0.1107
November.....	99,913	18,012	117,925	.2572	257,539		257,539	.0644
December.....	80,759	17,206	97,965	.3056	81,643		81,643	.3077
1912.								
January.....	91,634	13,003	104,637	.3484	79,502		79,502	.1795
February.....	79,340	22,238	101,578	.3329	215,833	3,478	219,311	.1942
March.....	80,263	20,045	100,308	.3184	236,380	7,638	244,018	.1543
April.....	34,428	7,690	42,118	.8038	127,629	22,415	150,044	.2612
May.....	30,990	27,693	58,683	.6176	73,508	27,022	100,530	.3026
June.....	30,345	27,712	58,057	.5830	74,091	14,689	88,780	.3334
Total.....	781,322	222,796	1,004,118		1,324,463	75,242	1,399,705	
Average cost.....				.3926				.1966
Plant arbitrary.....				.0522				.0522
Total division cost..				.4448				.2488

The revised estimate of the original channel excavation between Gatun and the Atlantic Ocean is shown in the following table, which also shows the amounts excavated to date:

Excavation table showing amounts creavated to date, July 1, 1912.

[Cubic yards.]

Depth, M. L. T.	Mile.		Original excavation.			Amounts excavated to date.					Grand total.
						Original exeavation.				Silting.	
	From—	To—	Earth:	Rock.	Total.	Earth.	Rock.	To anticipate silting.	Total.		
41 feet.	0	1	337,999	.....	337,999	260,027	.....	72,918	332,945	277,187	610,132
	1	2	908,512	.....	908,512	794,101	.....	488,444	1,282,545	1,399,252	2,681,797
	2	3	1,802,413	.....	1,802,413	1,740,794	.....	376,984	2,117,778	2,893,629	5,011,407
	3	4	2,775,961	461,262	3,237,223	2,320,620	380,478	28,617	2,729,715	3,781,836	6,511,551
	4	5	4,124,252	826,209	4,950,461	2,879,209	786,769	40,570	3,706,548	4,365,317	8,071,865
	5	5.46	1,672,733	650,624	2,323,357	1,405,649	523,258	31,703	1,960,610	406,768	2,367,378
	5.46	6	1,180,647	2,111,635	3,292,282	922,991	1,713,154	.....	2,636,145	31,460	2,667,605
	6	6.846	3,368,902	97,622	3,466,524	1,039,688	.....	.....	1,039,688	.....	1,039,688
	Total..		16,171,419	4,147,352	20,318,771	11,363,079	3,403,659	1,039,236	15,805,974	13,155,449	28,961,423
	6.64	690	859,560	93,547	953,107	692,704	75,242	.....	767,946	34,737	802,683
Total..		17,030,979	4,240,899	21,271,878	12,055,783	3,478,901	1,039,236	16,573,920	13,190,186	29,764,106	

¹ The channel silting has been 44.3 per cent of the total excavation.

The following table shows the estimated quantities remaining to be accomplished to complete the channel excavation between Gatun and the Atlantic Ocean on July 1, 1912:

Estimate of quantities remaining to be done June 30, 1912.

[Work excavation, Atlantic division, harbor and channel section. Work excavation remaining, in cubic yards.]

Station (miles and fractions).	Account No. 532.				
	Canal prism, wet.			Remaining maintenance of channel due to silting.	Grand total, in cubic yards.
	Earth.	Rock.	Total.		
0-1.....	77,972	.....	77,972	318,641	396,613
1-2.....	114,411	.....	114,411	800,748	915,159
2-3.....	61,619	.....	61,619	106,371	167,990
3-4.....	455,341	80,784	536,125	218,164	754,289
4-5.....	1,245,043	39,440	1,284,483	334,683	1,619,166
5-6.....	524,740	525,847	1,050,587	161,772	1,212,359
6-6.846.....	2,329,214	97,622	2,426,836	700,000	3,126,836
Total.....	4,808,340	743,693	5,552,033	2,640,379	8,192,412
6.64-6.90.....	166,856	18,305	185,161	.....	185,161
Total.....	4,975,196	761,998	5,737,194	2,640,379	8,377,573

COLON FILL.

The general raising of the surface east of D Street, which was in progress at the end of the last fiscal year, was completed on August 4, 1911.

Eighty-three thousand seven hundred and forty-one cubic yards of material were placed.

DRY DOCK SHOPS.

The oxy-acetylene and thermit welding processes were put into operation during the year. The motor generator was removed.

During the year 76 boats were docked. Some of the more important work was as follows:

Emergency dam for the dry dock completed.

Two derrick barges for Colon Breakwater completed.

Tug *Gatun* thoroughly overhauled.

Tug *Oscar*, of the Hamburg-American Line, given general repairs.

Numerous repairs were made to various steamships and the different pieces of floating equipment.

PORTO BELLO ROCK PLANT.

CRUSHED STONE QUARRY.

The output of crushed stone having been limited to three barges per day on June 19, 1911, the quarry and crushing plant were never operated at full capacity during the fiscal year 1911-12.

At the close of working hours on April 30, 1912, the work of securing crushed stone was completed. The quarry and plant had produced and shipped 1,921,579 cubic yards from March 2, 1909 (the date on which crushing was begun) to April 30, 1912. The following is a detailed statement of the output and cost for the year 1911-12:

Month.	Maximum day's output.		Average hourly output.		Monthly output.	Unit cost per cubic yard, including plant and division expense.		
	Time.	Cubic yards.	Working time.	Total time.		Operation.	Plant.	Total.
1911.	<i>H. m.</i>							
July.....	6 13	2,437	369.17	216.76	43,352	0.8499	0.5000	1.3439
August.....	5 23	2,176	389.20	193.64	41,826	.9653	.7688	1.7341
September.....	5 46	2,186	401.03	221.76	44,352	.7707	.6320	1.4027
October.....	5 30	2,358	413.08	209.79	43,638	.8187	.6320	1.4507
November.....	5 00	2,194	432.94	224.96	43,193	.6445	.6320	1.2765
December.....	4 53	2,220	468.32	211.24	42,247	.6806	.6320	1.3126
1912.								
January.....	4 48	2,279	479.78	225.28	46,858	.6017	1.0032	1.6047
February.....	4 50	2,234	505.21	216.11	41,493	.6786	1.0090	1.6876
March.....	4 30	2,050	458.25	227.32	47,282	.4246	1.0090	1.4336
April.....	5 15	2,176	472.95	229.79	46,172	.4701	1.0090	1.4791
Total.....			436.29	199.70	440,413	1.6859	.7421	1.4280

¹ Average.

BREAKWATER QUARRY.

During July and the first half of August, 1911, work was continued on the dock for the loading of stone for the Colon Breakwater and on the construction of tracks in the Breakwater quarry. On August 18 production was begun, using such equipment as could be spared from the crushed stone quarry.

On November 20 one of the cranes ordered for the quarry was put into service. A few weeks' work with this crane demonstrated that the stone could be loaded much more rapidly and economically by using heavy steam shovels, and the use of cranes for loading in the quarry was accordingly abandoned.

It was the original intention to use a 42-inch gauge in the tracks in the Breakwater quarry which would have permitted the continuance in service of the locomotives employed in the quarry for the production of crushed stone, and also of some flat cars of the same gauge which were on hand at Porto Bello. An additional number of 42-inch gauge flat cars had been ordered and purchased in the States. These cars were lost in transit by the wrecking of the steamer *Moldegaard*.

The experience had with the narrow gauge tracks in the Breakwater quarry indicated that the standard 5-foot gauge tracks would be more satisfactory, and after the loss of the 42-inch gauge cars it was decided to cancel the order for them and to adopt the 5-foot gauge for the quarry tracks, utilizing standard equipment available from other work on the canal. At the close of the year it had not been practicable to release the standard equipment from the work on which it was employed, and the quarry has been operated at a low rate of output with the incomplete narrow gauge equipment on hand.

A short time after operations were begun in the Breakwater quarry it was decided to increase the contemplated output beyond the

capacity of one loading dock, and after crushing was stopped the stone bins were demolished, and the stone-bin dock was reenforced and changed to adapt it to the use of cranes for loading. Work on this dock was practically completed on June 30, 1912, and loading of barges at this dock was begun a few days thereafter.

The face of the Breakwater quarry varies in height from 28 to 120 feet, owing to the fact that development was made along lines of railroad track already in place for use in connection with the crushed stone quarry.

The quarry is being developed in two benches. Each bench will have a breast of 60 feet at the highest point; 1,100 linear feet of lower bench has been developed and the upper bench when fully developed will have a length of 1,700 feet.

The following is a detailed statement of work done and costs for the year ending June 30, 1912:

Month.	Monthly output.	Unit cost per cubic yard.		
		Opera- tion.	Plant.	Total.
1911.	<i>Cu. yds.</i>			
July.....				
August.....	506	\$5.7201	\$0.2690	\$5.9891
September.....	2,822	3.0347	.2690	3.3037
October.....	3,484	3.0967	.2690	3.3657
November.....	4,117	2.4407	.2690	2.7097
December.....	6,179	2.4896	.2690	2.7586
1912.				
January.....	7,287	2.0397	.2340	2.2737
February.....	8,393	1.9284	.2340	2.1624
March.....	9,068	1.9633	.2340	2.1973
April.....	8,380	2.1007	.2340	2.3347
May.....	7,532	2.9865	.2340	3.2205
June.....	7,365	3.2578	.2340	3.4918

Length of working day, 8 hours.

The increased unit cost of production for the months of May and June, 1912, was due to the closing down on the 30th of April of the crushing operations which had theretofore borne a proportion of the overhead expenses.

The following table shows details of costs of quarry operation, water transportation, unloading, and storing crushed rock at Gatun:

Comparative statement, Porto Bello quarry.

	1911					
	July.	August.	September.	October.	November.	December.
Quarrying:						
Stripping.....	\$0.0079	\$0.0152	\$0.0087	\$0.0180	\$0.0080	\$0.0161
Dumps for stripping.....		.0064	.0019	.0048		
Drilling.....	.0587	.0636	.0465	.0486	.0440	.0532
Blasting.....	.1181	.2744	.2142	.1781	.1903	.1590
Loading.....	.1018	.0923	.0833	.0780	.0716	.0763
Transportation.....	.0814	.0851	.0793	.0738	.0644	.0705
Tracks.....	.0400	.0334	.0198	.0404	.0366	.0428
Power.....	.0274	.0398	.0409	.0374	.0362	.0375
Maintenance of equipment.....	.0417	.0799	.0756	.1402	.0304	.0803
Plant arbitrary.....	.3300	.5072	.4170	.4170	.4170	.4170
Total.....	.8070	1.1973	.9872	1.0363	.8985	.9205

Comparative statement, Porto Bello quarry—Continued.

	1911					
	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.
Crushing:						
Operation of crushers.....	\$0.0644	\$0.0331	\$0.0266	\$0.0280	\$0.0230	\$0.0255
Stone bins and conveyors.....	.0468	.0168	.0120	.0129	.0120	.0159
Power.....	.0509	.0512	.0525	.0481	.0466	.0483
Maintenance of equipment.....	.1702	.1303	.0769	.0816	.0589	.0640
Plant arbitrary.....	.1700	.2616	.2150	.2150	.2150	.2150
Total.....	.5023	.4930	.3830	.3856	.3555	.3687
Water transportation:						
Operation of tugs and barges.....	.1645	.1843	.1662	.1379	.1583	.2039
Maintenance of equipment.....	.0844	.1480	.0690	.0529	.1374	.1546
Plant arbitrary.....	.1710	.2748	.2220	.2220	.2220	.2220
Total.....	.4199	.6071	.4572	.4128	.5177	.5805
Unloading barges and transporting to rock pile, Gatun.....	.2868	.3210	.2275	.2482	.3454	.2463
Plant arbitrary.....	.2070	.3312	.2680	.2680	.2680	.2680
Total.....	.4938	.6522	.4955	.5162	.6134	.5143
Division expense.....	.0406	.0438	.0325	.0288	.0225	.0234
Grand total cost.....	2.2636	2.9934	2.3554	2.3797	2.4076	2.4074
Output (cubic yards).....	43,352	41,826	44,352	43,638	43,193	42,247

	1912					
	January.	Febru-ary.	March.	April.	May.	June.
Quarrying:						
Stripping.....	\$0.0158	\$0.0212	.....	\$0.0149	.....	.....
Dumps for stripping.....	.0011	.....	.....	.....	.....	.....
Drilling.....	.0419	.0473	\$0.0267	.0027	.....	.....
Blasting.....	.1467	.1445	.0987	.1132	.....	.....
Loading.....	.0580	.0785	.0656	.0724	.....	.....
Transportation.....	.0504	.0618	.0537	.0518	.....	.....
Tracks.....	.0322	.0253	.0302	.0335	.....	.....
Power.....	.0326	.0365	.0311	.0335	.....	.....
Maintenance of equipment.....	.0604	.1086	.0232	.0441	.....	.....
Plant arbitrary.....	.6622	.6660	.6660	.6660	.....	.....
Total.....	1.0697	1.1897	.9488	1.0023	.....	.....
Crushing:						
Operation of crushers.....	.0186	.0209	.0205	.0240	.....	.....
Stone bins and conveyors.....	.0182	.0135	.0090	.0121	.....	.....
Power.....	.0406	.0453	.0387	.0417	.....	.....
Maintenance of equipment.....	.0961	.0556	.0552	.0357	.....	.....
Plant arbitrary.....	.3410	.3430	.3430	.3430	.....	.....
Total.....	.5145	.4783	.4664	.4565	.....	.....
Water transportation:						
Operation of tugs and barges.....	.1454	.1473	.1341	.1205	.....	.....
Maintenance of equipment.....	.1511	.1781	.0930	.1470	.....	.....
Plant arbitrary.....	.1183	.1190	.1190	.1190	.....	.....
Total.....	.4148	.4444	.3461	.3865	.....	.....
Unloading barges and transporting to rock pile, Gatun.....	.3196	.2502	.1741	.1702	.....	.....
Plant arbitrary.....	.4504	.4530	.4530	.4530	.....	.....
Total.....	.7700	.7032	.6271	.6232	.....	.....
Division expense.....	.0205	.0196	.0184	.0203	.....	.....
Grand total cost.....	2.7895	2.8352	2.4068	2.4888	.....	.....
Output (cubic yards).....	46,858	41,493	47,282	46,172	.....	.....

The following table shows details of costs of operation of Breakwater quarry, water transportation, and placing of large rock in the Colon Breakwater:

Comparative statement, Porto Bello large rock quarry.

	1911					
	July.	August.	September.	October.	November.	December.
Quarrying:						
Stripping.....		\$0. 1034	\$0. 0016	\$0. 1182	\$0. 0849	\$0. 6543
Drilling.....		1. 1407	. 4178	. 3824	. 1893	. 1762
Blasting.....		. 5438	. 9227	. 4772	. 3929	. 2950
Loading.....		. 9001	. 3021	. 3273	. 2095	. 1889
Transportation.....		. 2041	. 2337	. 2848	. 2539	. 1759
Tracks.....		1. 1411	. 2277	. 3839	. 3898	. 3502
Loading on barges.....		. 0336	. 1486	. 1620	. 1438	. 1288
Power.....		. 7305	. 1430	. 1039	. 0842	. 0569
Maintenance of equipment.....		. 9228	. 6375	. 8570	. 6924	. 4634
Plant arbitrary.....		. 2690	. 2690	. 2690	. 2690	. 2690
Total.....		5. 9891	3. 3037	3. 3657	2. 7097	2. 7586
Towing:						
Operation, tugs and barges.....		. 7817	. 2690	. 2364	. 2657	. 4169
Maintenance of equipment.....		. 1691	. 0298	. 0330	. 0834	. 0452
Plant arbitrary.....		. 4930	. 4930	. 4930	. 4930	. 4930
Total.....		1. 4438	. 7918	. 7624	. 8421	. 9551
Placing large rock—Toro Point:						
Operation, floating derricks.....				. 0130		
Maintenance, floating derricks.....						
Operation, cranes on dock.....		. 4647	. 2807	. 1759	. 1519	. 1038
Operation, trains.....		. 4447	. 1172	. 0316	. 0314	. 0704
Dumping.....				. 0097	. 0483	. 0163
Maintenance of equipment.....		. 0814	. 0300	. 0896	. 0772	. 0588
Plant arbitrary.....		. 1400	. 1400	. 1400	. 1400	. 1400
Total.....		1. 1308	. 5679	. 4598	. 4488	. 3893
Division expense.....		. 4847	. 1877	. 1573	. 1192	. 1252
Total division cost.....		9. 0484	4. 8511	4. 7452	4. 1198	4. 2282
Output (cubic yards).....		506	2, 822	3, 484	4, 117	6, 179

	1912					
	January.	February.	March.	April.	May.	June.
Quarrying:						
Stripping.....	\$0. 3944	\$0. 3765	\$0. 1674	\$0. 2666	\$0. 7948	\$1. 0290
Drilling.....	. 1329	. 0946	. 1752	. 1907	. 2614	. 2614
Blasting.....	. 3033	. 2403	. 2028	. 2715	. 2492	. 3159
Loading.....	. 2626	. 3396	. 3917	. 3784	. 2320	. 2421
Transportation.....	. 2252	. 1756	. 2301	. 2416	. 1802	. 1630
Tracks.....	. 2147	. 2183	. 2250	. 1618	. 2484	. 2664
Loading on barges.....	. 1439	. 1262	. 1351	. 1620	. 0955	. 1299
Power.....	. 0464	. 0399	. 0360	. 0409	. 1877	. 2446
Maintenance of equipment.....	. 3163	. 3174	. 4000	. 3872	. 7373	. 6055
Plant arbitrary.....	. 2340	. 2340	. 2340	. 2340	. 2340	. 2340
Total.....	2. 2737	2. 1624	2. 1973	2. 3347	3. 2205	3. 4918
Towing:						
Operation, tugs and barges.....	. 3094	. 2577	. 3054	. 2852	. 4780	. 5047
Maintenance of equipment.....	. 1612	. 1225	. 0482	. 0425	. 2674	. 1659
Plant arbitrary.....	. 4040	. 4040	. 4040	. 4040	. 4040	. 4040
Total.....	. 8746	. 7842	. 7576	. 7317	1. 1494	1. 0746

Comparative statement, Porto Bello large rock quarry—Continued.

	1912					
	January.	February.	March.	April.	May.	June.
Placing large rock—Toro Point:						
Operation, floating derricks.....					\$0.0870	\$0.0688
Maintenance, floating derricks.....					.0386	
Operation, cranes on dock.....	\$0.1391	\$0.1437	\$0.1743	\$0.1851	.1961	.2029
Operation, trains.....	.0398	.0299	.0966	.1088	.1221	.0860
Dumping.....	.0014	.0347	.0163	.0176	.0331	.0242
Maintenance of equipment.....	.0426	.0462	.1222	.1545	.2116	.1972
Plant arbitrary.....	.1290	.1290	.1290	.1290	.1290	.1290
Total.....	.3519	.3835	.5384	.5950	.8175	.7081
Division expense.....	.1288	.1121	.1200	.1522	.2775	.3443
Total division cost.....	3.6290	3.4422	3.6133	3.8136	5.4649	5.6188
Output (cubic yards).....	7,287	8,393	9,068	8,380	7,532	7,365

WATER TRANSPORTATION.

In connection with this service the plant steamed about 58,000 miles, handled about 6,483 barges, and carried about 28,273 passengers.

During the year barges *No. 6* and *No. 8* were transferred to the fortification work and the tug *Reliance*, with barges *No. 1*, *No. 7*, and *No. 10*, transferred to the Pacific division.

During June about 13,000,000 gallons of water were hauled in barges from Gatun to Dock 13 and there pumped into the Cristobal mains. This service was discontinued on June 24.

COLON BREAKWATER.

During the year 5,514 linear feet of double-track trestle and 48 linear feet of single-track trestle were built; 460.040 cubic yards of fill were dumped from the trestle; 6,498 cubic yards of material were used for ballast, and 4,680 cubic yards were furnished to the fortifications.

Steam-shovel work was completed on June 22, 1912.

Unloading Porto Bello rock for the armor of the breakwater was begun in August, 1911. The rock is removed from barges to Lidgerwood trains by locomotive cranes and plowed off in the north side of the trestle. On June 30, 1912, 65,133 cubic yards had been unloaded.

The amount of rock dredged and dumped in the vicinity of the west breakwater was 510,780 cubic yards.

Comparative statement, Colon Breakwater.

	1911					
	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.
Excavation:						
Surveys.....				\$0. 0013	\$0. 0012	
Drilling.....	\$0. 0221	\$0. 0204	\$0. 0058			\$0. 0116
Blasting.....	. 1647	. 1481	. 0625	. 0110	. 0334	. 0327
Loading by power.....	. 0631	. 0933	. 1339	. 0890	. 1119	. 0778
Tracks.....	. 0647	. 0435	. 0442	. 0617	. 0712	. 0106
Transportation.....	. 0940	. 0898	. 0944	. 0733	. 1053	. 0724
Maintenance of equipment.....	. 0765	. 0725	. 0364	. 0678	. 2474	. 0365
Total.....	. 4851	. 4676	. 3772	. 3041	. 5709	. 1686
Filling:						
Trestles.....	1. 1696	. 9154	. 6741	. 5275	1. 6023	. 5150
Dumping.....	. 0082	. 0084	. 0119	. 0187	. 0137	. 0140
Maintenance of equipment.....	. 0220	. 0066	. 0175	. 0291	. 0142	. 0395
Total.....	1. 1998	. 9304	. 7035	. 5753	1. 6302	. 5685
Plant arbitrary.....	. 1690	. 4548	. 3100	. 3100	. 3100	. 3100
Division expense.....	. 0340	. 0381	. 0388	. 0392	. 0458	. 0202
Tug service.....	. 0663	. 0844	. 0793	. 1076	. 2050	. 0653
Total division cost.....	1. 9542	1. 9753	1. 5088	1. 3362	2. 7619	1. 1326
Output (cubic yards).....	46, 179	44, 958	33, 813	21, 815	17, 249	46, 591

	1912					
	January.	Febru-ary.	March.	April.	May.	June.
Excavation:						
Surveys.....					\$0. 3001	
Drilling.....	\$0. 0097	\$0. 0132	\$0. 0072	\$0. 0328	. 0289	\$0. 0431
Blasting.....	. 0330	. 0538	. 0541	. 0899	. 0736	. 0499
Loading by power.....	. 0749	. 0693	. 0902	. 0750	. 1000	. 0682
Tracks.....	. 0268	. 0149	. 0194	. 0045	. 0317	. 0448
Transportation.....	. 0784	. 0828	. 0610	. 0622	. 0638	. 0961
Maintenance of equipment.....	. 0309	. 0283	. 0590	. 0460	. 0468	. 0661
Total.....	. 2537	. 2623	. 2909	. 3104	. 3447	. 3682
Filling:						
Trestles.....	. 3130	. 5160	. 4366	. 3594	. 4349	. 2618
Dumping.....	. 0107	. 0106	. 0090	. 0068	. 0068	. 0063
Maintenance of equipment.....	. 0109	. 0060	. 0047	. 0074	. 0080	. 0100
Total.....	. 3346	. 5326	. 4503	. 3736	. 4497	. 2781
Plant arbitrary.....	. 2960	. 2960	. 2960	. 2960	. 2960	. 2960
Division expense.....	. 0210	. 0175	. 0187	. 0230	. 0273	. 0496
Tug service.....	. 0798	. 0821	. 0648	. 0639	. 0828	. 1148
Total division cost.....	. 9851	1. 1905	1. 1207	1. 0669	1. 2005	1. 1067
Output (cubic yards).....	48, 423	42, 927	48, 401	46, 583	44, 009	19, 092

PROCURING SAND AT NOMBRE DE DIOS.

During the year 144,123 cubic yards of sand were excavated by dredge *No. 4* and shipped to Gatun.

This work was completed on November 17, 1911, and the plant removed to Cristobal.

The operating cost of procuring sand at Nombre de Dios is shown, by months, below :

	July.	August.	September.	October.	November.
Dredging excavation:					
Clearing.....	\$0.0008				
Operation, dredge No. 4.....	.2481	\$0.1762	\$0.1598	\$0.1348	\$0.1632
Operation, small boats, etc.....	.0264	.0296	.0171	.0140	.0211
Maintenance of equipment.....	.0295	.0113	.0524	.0344	.0927
Plant, arbitrary.....	.4800	1.0613	.7890	.7890	.7890
Total operating cost.....	.7258	1.2784	1.0183	.9722	1.0660
Water transportation:					
Operation of tugs and barges.....	.2297	.2244	.2240	.2048	.2449
Maintenance of equipment.....	.0838	.1630	.1251	.0832	.1140
Plant, arbitrary.....	.2110	.3446	.2820	.2820	.2820
Total.....	.5245	.7320	.6311	.5700	.6409
Unloading barges and transporting sand to pile at Gatun.....	.2732	.3382	.2291	.2313	.2781
Plant, arbitrary.....	.1620	.2654	.2170	.2170	.2170
Total.....	.4352	.6036	.4461	.4483	.4951
Division expense.....	.0122	.0115	.0085	.0059	.0131
Grand total.....	1.6977	2.6255	2.1040	1.9964	2.2151
Output (cubic yards).....	24,512	27,818	32,401	39,444	19,948

SURVEYS.

In addition to the usual weekly and monthly routine work the following surveys were made:

Fortification reserve at Toro Point.
Channel and bar at mouth of Chagres River.
Coast line, Las Minas Bay to Margarita Point.
Limon Bay and Colon Breakwater.
Nombre de Dios.

GATUN LOCKS.

[Maj. James P. Jervcy, Corps of Engineers, U. S. Army, resident engineer in local charge.]

EXCAVATION.

At the beginning of the fiscal year 1911-12 all excavation necessary for the construction of the locks proper had been completed, with the exception of 1 per cent of the trench excavation in the lower lock, amounting to 8,888 cubic yards.

The excavation north of the north caisson sill necessary for the construction of the flare walls and middle approach wall is being carried on by suction and dipper dredges. In order to reach suitable rock for the foundations of the flare walls it is necessary to excavate in places to a depth of 70 feet below sea level, through soft, sliding mud, too soft to support steam shovels. In order that this material could be removed by dredges, the lock chambers were closed by a temporary reinforced concrete buttress dam, with wood face, erected on the north caisson sill. This dam is 46½ feet high, 220 feet long, and contains 1,040 cubic yards of reinforced concrete and

98,736 feet b. m. of timber. Its cost was \$36,092.91. This makes it practicable to keep the locks unwatered, so that gate and machinery erection can proceed while excavation for the flare and guide walls is being made. The dredges excavated a narrow, shallow channel into the site of these walls, and are widening and deepening the cut, removing all material above rock back of the flare walls that would have slipped into excavation when finally unwatered. In order to excavate to depth of 70 feet below sea level an earth dam across the narrow entrance channel has been built, so that suction dredge can lower water plane to 30 feet below sea level, thus enabling dredges to complete excavation. When this excavation is completed the excavated space will be filled with water, the dam will be removed, dredges floated out, dam rebuilt, and space finally unwatered for wall construction.

The total amount of material to be excavated by the dredges for the construction of the flare and approach walls is 973,488 cubic yards, of which 883,918 cubic yards had been excavated up to June 30, 1912, at a cost of 31.29 cents per cubic yard. This cost includes the cost of the reinforced concrete dam referred to above.

CONCRETE MATERIAL.

During the year a total of 376,898 cubic yards of crushed stone and 162,785 cubic yards of sand have been unloaded and stored. Four hundred and forty-eight thousand, seven hundred and one barrels of cement in bags have been received.

By April 30, 1912, sufficient rock had been received for the completion of the work and deliveries from Porto Bello were stopped. Screened and washed rock for facing and reinforced concrete work have been secured by a revolving screen with washing attachment. While rock was being received from Porto Bello the screen was fed by a derrick directly from the barges. Since then the screen has been mounted on a flat car and moved to one side of the rock storage pile, where it is fed by one of the cableways.

The delivery of sand from Nombre de Dios was discontinued on November 17, 1911. On December 29, 1911, shipments of Chamé sand began from the Pacific division and were continued during January, February, and March, a total of 20,315 cubic yards being received. Arrangements were then made for securing sand from one of the dredges filling into the dam from the old bed of the Chagres River, north of the north toe of the dam, and since May 15 40.025 cubic yards have been received from this source, 1,265 yards in cars and 38,760 yards in barges which were unloaded by the cableways.

The cost of the Nombre de Dios sand received during the fiscal year 1911-12 has been \$2.2414 per cubic yard; the cost of the Chame sand was \$1.7079 per cubic yard; and the cost of the sand from the dam \$1.2850 per cubic yard. The costs given are for sand on the storage pile.

On June 30, 1912, the amount of sand needed for the completion of the work, in addition to the amount then in the storage pile, was 39,000 cubic yards.

The delivery of cement in barges was discontinued on April 30, 1912, and the remainder will be delivered in cars and unloaded by hand. On June 30, 1912, the amount of cement needed for the completion of the work, in addition to the amount then in storage, was 190,000 barrels.

UNLOADING PLANT.

Beginning July 1, 1911, the unloading cableways have been regularly operated on a single shift of 9 hours. Occasional 12-hour shifts have been worked since June 1, 1912, to facilitate the delivery of sand from the Chagres River.

During the fiscal year the cableways unloaded 237,750 cubic yards of rock and 109,017 cubic yards of sand, at the rate of 52.74 cubic yards per hour actual working time, at a total cost for unloading of 19.04 cents per cubic yard.

The necessary reclaiming of rock and sand from the stock piles to the tunnel hoppers and to cars has also been done by the cableways. Since May 23, 1912, one duplex cableway has been employed exclusively with the rock screen.

From July 1 to November 16, 1911, five derricks were used for unloading rock and sand. The use of the two sand derricks was discontinued on the latter date, and of the three rock derricks on April 29, 1912. During the time they were in service the derricks unloaded 139,148 cubic yards of rock and 53,768 cubic yards of sand, at a cost of 15.73 cents per cubic yard.

From July 1, 1911, to April 30, 1912, when the delivery of cement in barges was discontinued, the cement-shed cranes unloaded 448,700 barrels of cement.

HANDLING AND MIXING PLANTS.

The handling and mixing plants have been operated satisfactorily during the year.

The Automatic Railway has handled about 624,902 tons of material at a cost of 5.88 cents per ton. The Industrial Railway has handled about 686,728 tons of material at a cost of 8.51 cents per ton.

Mixing plant No. 1 has mixed a total of 343,364 cubic yards of concrete. Mixing plant No. 2 mixed a total of 80,544 cubic yards of concrete. This plant was shut down on March 11, 1912, and the work of dismantling commenced on March 12, 1912. A total of 15,758 cubic yards of concrete was mixed by portable mixers and by hand.

CONCRETE WORK.

At the beginning of the fiscal year the total amount of concrete placed was 1,424,940 cubic yards, and on a basis of 2,000,000 cubic yards the masonry work for the entire system of locks was 71.25 per cent completed.

During the year 391,142 cubic yards of plain concrete, and 59,883 cubic yards of reenforced concrete have been placed, making a total for the year of 451,025 cubic yards, and a total to date of 1,875,965 cubic yards. The total amount of concrete laid during the year included 14,194 cubic yards of large rock.

In general, the massive work of the lock walls proper is completed. The flare walls at the south end are completed. The south middle approach wall is 67 per cent completed. The bulk of the remaining concrete will be placed in the north flare walls and approach wall.

The costs for plain concrete, as reported, show a considerable increase during the fiscal year, due to the larger proportion which has been placed in machinery chambers, where the setting of fixed irons has complicated the work.

The average division cost for the year for taking concrete material from storage, mixing and placing in the lock walls, including the plant charge, has been as follows:

	Cost per cubic yard.
Forms-----	\$0. 6580
Mixing-----	. 1798
Placing and finishing-----	. 4788
Reenforcements-----	. 0173
Pumps-----	. 0878
Power-----	. 0834
Maintenance of equipment-----	. 2109
Plant arbitrary-----	. 8980
Division expense-----	. 1015
Total-----	2. 7155

(Mixing includes a haul of 2,000 feet and a lift of 63 feet for 66.6 per cent of the total amount of concrete placed.)

Attached are comparative statements of concrete costs for the year. These statements include all concrete laid with the exception of 531 cubic yards placed in connection with installation of vitrified tile duct.

Comparative statement of costs.

GATUN LOCK CONSTRUCTION.

Masonry.	1911					
	July.	August.	Septem- ber.	October.	Novem- ber.	Decem- ber.
Concrete (cubic yards)	64, 199	59, 332	51, 650	45, 723	38, 008	36, 567
Cement.....	\$1. 5563	\$1. 5729	\$1. 5648	\$1. 6236	\$1. 7459	\$1. 6088
Stone.....	1. 9915	2. 2000	2. 1484	2. 0479	1. 9524	1. 6902
Sand.....	. 8365	. 9811	. 9461	. 9497	1. 0032	1. 3079
Mixing.....	. 1335	. 1446	. 1541	. 1428	. 1751	. 2078
Total cost.....	4. 5178	4. 8986	4. 8134	4. 7640	4. 8766	4. 8147
Large rock (cubic yards).....	5, 370	4, 416	1, 634	1, 424	1, 014	308
Cost.....	\$0. 7806	\$1. 2564	\$1. 1203	\$1. 2712	\$2. 4159	\$9. 4562
Masonry (cubic yards).....	69, 569	63, 748	53, 284	47, 147	39, 022	36, 875
Concrete.....	\$4. 1690	\$4. 5593	\$4. 6658	\$4. 6201	\$4. 7500	\$4. 7745
Large rock.....	. 0603	. 0870	. 0344	. 0384	. 0628	. 0790
Wood forms.....	. 4265	. 4774	. 3698	. 3372	. 4608	. 5170
Steel forms.....	. 1302	. 1287	. 1506	. 1829	. 1837	. 2045
Placing.....	. 3240	. 3632	. 3725	. 4653	. 5008	. 4949
Reenforcements.....	. 0083	. 0244	. 0157	. 0080	. 0201	. 0258
Pumps.....	. 0719	. 0968	. 0831	. 0989	. 1280	. 0893
Power.....	. 0425	. 0473	. 0751	. 1212	. 1054	. 0855
Maintenance of equipment.....	. 2001	. 1771	. 1637	. 2199	. 2500	. 2317
Plant arbitrary.....	. 7110	1. 0644	. 8800	. 8800	. 8800	. 8800
Division expense.....	. 0821	. 1033	. 0874	. 0861	. 0894	. 0986
Total division cost.....	6. 2259	7. 1289	6. 8981	7. 0580	7. 4310	7. 4808

Comparative statement of costs—Continued

GATUN LOCK CONSTRUCTION—Continued.

Masonry.	1912					
	January.	February.	March.	April.	May.	June.
Concrete (cubic yards).....	28,778	21,071	20,877	5,481	3,506	1,225
Cement.....	\$1.6730	\$1.8562	\$1.7852	\$1.5068	\$1.5391	\$2.2541
Stone.....	1.9432	1.8870	1.8367	1.9121	1.4322	1.8601
Sand.....	1.3194	1.1455	.9636	.9181	.7837	.8640
Mixing.....	.2560	.2386	.1773	.3292	.8032	.5359
Total cost.....	5.1916	5.1273	4.7628	4.6662	4.5582	5.5141
Large rock (cubic yards).....	28					
Cost.....	\$3.9718					
Masonry (cubic yards).....	28,806	21,071	20,877	5,481	3,506	1,225
Concrete.....	\$5.1867	\$5.1273	\$4.7628	\$4.6662	\$4.5582	\$5.5141
Large rock.....	.0038					
Wood forms.....	.6454	.7958	.5744	1.4684	1.6367	3.6212
Steel forms.....	.1221	.1327	.1192	.1290	.1435	.0397
Placing.....	.5746	.8270	.6039	1.2774	1.2465	3.0780
Reinforcements.....	.0118	.0367	.0235	.0061	.0151	
Pumps.....	.1169	.0296	.0427	.1549		
Power.....	.1037	.1102	.1010	.1502	.2573	.4010
Maintenance of equipment.....	.1881	.2268	.2000	.2588	.6223	1.4610
Plant arbitrary.....	.9670	.9670	.9670	.9670	.9670	.9670
Division expense.....	.1135	.1068	.1047	.2594	.3710	.8712
Total division cost.....	8.0336	8.3599	7.4992	9.3374	9.8176	15.9532

LOCK MASONRY, REENFORCED.

	1911					
	July.	August.	September.	October.	November.	December.
Cement.....	\$2.2820	\$2.2500	\$2.2040	\$1.9871	\$2.3520	\$2.2997
Stone.....	1.9997	2.3353	1.9788	2.3917	1.9323	1.8375
Sand.....	.7548	1.0054	.9010	1.2419	1.0040	1.2976
Mixing.....	1.5547	1.1060	.5568	.5848	.6030	.4849
Forms.....	5.5897	3.7445	4.3327	2.8834	3.6607	2.0398
Power.....						.0498
Placing.....	.7727	.7264	.6528	.5180	.4359	.5193
Reenforcements.....	1.9732	.6520	1.3569	1.3915	.7938	.8602
Pumps.....			.0209			
Maintenance of equipment.....	.0942	.0716	.2221	.2249	.0296	.2162
Plant arbitrary.....	.7110	.9585	.8800	.8800	.8800	.8800
Division expense.....	.4879	.3864	.3258	.2614	.2298	.1750
Total division cost.....	16.2199	13.2361	13.4318	12.3647	11.9211	10.6600
Administration and general expense.....	1.7526	1.1013	1.1841	.6067	.9685	.6539
Total cost.....	17.9725	14.3374	14.6159	12.9714	12.8896	11.3139
Concrete placed (cubic yards).....	1,477	3,180	4,014	6,489	4,885	6,715

Comparative statement of costs—Continued.

LOCK MASONRY, REENFORCED—Continued.

	1912					
	January.	February.	March.	April.	May.	June.
Cement.....	\$2.5355	\$2.5112	\$2.4360	\$1.8165	\$1.8703	\$1.8992
Stone.....	2.0825	2.0163	1.8000	1.8725	1.6956	2.0450
Sand.....	1.2602	1.0926	.9466	.8781	.7670	.8574
Mixing.....	.4323	.5765	.3324	.4245	.8002	.6789
Forms.....	2.7311	2.7274	2.5777	2.5426	3.2162	2.5401
Power.....	.0202	.0376	.0304	.1129	.0459	.0420
Placing.....	.6011	.7362	.7985	.9164	1.3738	1.0756
Reenforcements.....	.6677	.4392	1.0587	.2864	.7900	.8694
Maintenance of equipment.....	.1857	.1358	.1538	.2139	.4629	.3871
Plant arbitrary.....	.9670	.9670	.9672	.9670	.9670	.9670
Division expense.....	.2466	.2078	.2233	.2454	.3451	.4111
Total division cost.....	11.7299	11.4476	11.3246	10.2762	12.3340	11.7728
Administration and general expense.....	.7245	.7719	.7110	.6543	1.0761	.9542
Total cost.....	12.4544	12.2195	12.0356	10.9305	13.4101	12.7270
Concrete placed (cubic yards).....	6,177	5,593	6,655	6,119	4,000	4,579

POWER PLANT.

The operation of the power plant during the year has been satisfactory.

The total production of electrical energy was 16,263,510 kilowatt hours.

The average fuel consumption was 0.007592 barrels of oil per kilowatt hour.

An air compressor, with a capacity of 1,100 cubic feet of free air per minute, transferred from Porto Bello has been installed at the power plant, and is being operated for the first division.

The condensers have continued to give trouble during the year, due to the use of salt water for circulation. This salt water causes electrolytic action to be set up between the copper tubes and the cast-iron tube sheets, which results in bad corrosion of the sheets. This corrosion makes it difficult to secure tight joints between tubes and sheets and necessitates frequent renewal of tubes. It does not appear to be practicable to obtain fresh water for circulating purposes, nor to rebuild the condensers at a cost warranted by the probable future output of the plant, so it will be endeavored to keep the present condensers in as good condition as is possible under the circumstances.

TESTS.

During the month of September, 1911, various tests were made on Stoney gates Nos. 260 and 261 under full head, with a view to determining the power necessary to raise the gates. The result of these tests showed an average combined coefficient of friction for a 79-foot head of 0.0433.

GATE ERECTION.

The work of the Atlantic division in connection with gate erection consisted, during the year, in preparing the necessary storage ground and construction of the necessary storage and erection tracks for the storage of the gates. A total of approximately 7,500 feet of standard-gauge track has been built specially for this work.

FIXED STEELWORK.

The erection of fixed steel during the year has included the placing of reaction castings, material in Stoney gate valves, material in gate sills, snubbing hooks, anchorage bolts, etc. A total of 3,179.2 tons of fixed steel has been placed during the year.

At the end of the year all reaction castings, steel in all gate sills, and all snubbing hooks had been placed.

A total of 42 Stoney gate valves were ready to be turned over to the first division for the installation of the machinery.

SLIDES.

Slides at the extreme north end of the locks continued to give trouble during the year, and the cableway tracks could not be extended so as to cover all walls as far north as the north caisson sill until January.

BACK FILL.

Back filling behind the side walls of all locks has been continued during the year. The back fill in the center wall of the upper and middle locks has been completed.

In connection with this work, a total of 928,406 cubic yards of material were removed by steam shovels from borrow pits, at a cost of 45.84 cents per cubic yard. All of this was placed as back fill, with the exception of small quantities used from time to time for construction tracks.

A total of 1,462,074 cubic yards, at an average cost of 48.88 cents per cubic yard, had been placed behind the side walls up to June 30, 1912, and 97,291 cubic yards, at an average cost of 80.03 cents per cubic yard, in the center wall.

MISCELLANEOUS WORK.

A total of 73,695 linear feet of concrete piling was manufactured during the year; 75,474 feet were driven for foundation of south approach wall and 10,609 feet for foundation of emergency dam; 1,412 feet of pipe piles were also driven for foundation of emergency dam.

Twenty thousand six hundred and thirteen feet of coping drain covers, and 462 deck light covers were manufactured during the year; 154,781 feet 10 inches of tile duct were laid.

A total of 699 feet of tile gauges was set during the year, completing all gauges except those north of the north caisson sill.

The dismantling and removal of the form towers was 60 per cent completed during the year.

GATUN DAM AND SPILLWAY.

[Maj. George M. Hoffman, Corps of Engineers, U. S. Army, resident engineer, in local charge.]

GATUN DAM.

Construction during the year increased the embankment by 5,525,945 cubic yards, making the total net fill in place 19,818,979 cubic yards. To accomplish this, 9,048,896 cubic yards of material, borrow pit measurement, was handled, thus showing a loss of 38.9 per cent due to consolidation, waste, and other minor causes. Of the amount placed this year, 2,982,859 cubic yards was dry fill, and 2,543,086 cubic yards was wet fill. To complete the embankment to approved grade and section will require the placing of 1,652,832 cubic yards, net. The quantities for the year, as shown on monthly reports, are 2,608,073 cubic yards dry fill, and 2,604,632 cubic yards wet fill. After the semiannual survey, which was completed in January, a reduction of 63,547 cubic yards was made from dry fill, and 61,546 cubic yards from wet fill on account of slow consolidation in excess of amounts allowed in monthly estimates. An addition of 438,333 cubic yards was made to dry fill on account of change in approved slope of dam, which brought within the area of the dam an old dump not previously included.

Statement of the progress of construction by fiscal years is as follows, showing the dam to be 92.18 per cent completed:

Year.	Embankment.		
	Dry fill.	Wet fill.	Total fill.
	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
Prior to July 1, 1908.....	462,297	462,297	462,297
1908-9.....	1,781,325	720,047	2,501,372
1909-10.....	2,577,234	2,933,075	5,510,309
1910-11.....	2,060,186	3,758,870	5,819,056
1911-12.....	2,982,859	2,543,086	5,525,945
Total.....	9,863,901	9,955,078	19,818,979

For a distance of 1,000 feet east of the spillway the north and south dumps of dry fill have been advanced across the hydraulic fill to a junction at the axis, thus practically completing this section to elevation 103.35. Adjacent to the axis the dry fill is of impervious clay, thoroughly puddled by sluicing, thus extending the water-tight hydraulic fill core to the top of the dam. From this completed section to the east end of the dam the dumps have reached a general elevation of +96, and the hydraulic fill between has a general elevation of +85. West of the spillway the north and south dumps have reached a general elevation of +98, the hydraulic fill varying from elevation +87 at the spillway to +78 at the west-end drains. Plate 81 shows sections east and west of the spillway, indicating thereon the progress made during the year.

With the object of checking the net yardage of the embankment above the original surface, complete cross-section surveys were made of the entire dam in December, 1911, and June, 1912. For the

monthly estimates only partial cross sections were taken, time available being sufficient only to cover the areas worked over during the month. An arbitrary amount of 40,000 cubic yards has been deducted each month to allow for slow consolidation in the areas not cross-sectioned, this amount being subject to redetermination after the semiannual surveys.

Levels have been run monthly over the regular consolidation hubs driven on both slopes about 250 feet apart parallel to the axis and about 100 feet apart transverse thereto. In addition, levels were run weekly over the consolidation hubs in two sections east of the spillway where special and more frequently taken data were desired.

Borings have been made across two sections of the embankment and at special points, giving valuable data as to solidity of material in and below the dam, line of demarcation between dry and wet fill, water-tightness and other qualities of the interior wet fill.

Dry fill deposited in dumps forming slopes of the dam was received from various sources, as follows, quantities being in accordance with car measurement:

Locality:	Cubic yards.
Central division-----	1, 465, 596
Locks-----	448
Mindi-----	15, 962
Spillway and borrow pits-----	1, 530, 364
Total-----	3, 012, 370

Measured in place in the dam, dry fill received shows a loss of 10 per cent, due to consolidation, intermixture with wet fill, etc., thus making the net amount 2,982,859 cubic yards.

Prior to February 15 the bulk of dry fill for the dam came from the central division, but on that date the double-track line south of Gatun was abandoned and trains from the central division were discontinued. To provide dry fill for completion, a high-level borrow pit was developed in the hills west of the dam, which in addition to the clay borrow pits will furnish material of the quantity and class required. From two to six steam shovels have been engaged in excavating material for dry fill, their output being as follows:

[Cubic yards.]

Months.	Earth.	Rock.	Total.	Output per shovel. ¹	
				Per day.	Per month.
1911.					
July.....	31, 665	-----	31, 665	1, 319	32, 984
August.....	34, 432	-----	34, 432	1, 324	33, 108
September.....	31, 226	9, 157	40, 383	1, 154	28, 846
October.....	45, 647	8, 796	54, 443	1, 067	26, 689
November.....	36, 080	27, 880	63, 960	1, 332	33, 312
December.....	31, 691	32, 578	64, 269	1, 285	32, 134
1912.					
January.....	15, 565	52, 111	67, 676	1, 327	33, 178
February.....	41, 152	62, 631	103, 783	1, 365	34, 139
March.....	100, 597	171, 118	271, 715	1, 889	47, 189
April.....	208, 666	133, 328	341, 994	2, 279	56, 999
May.....	140, 677	146, 430	287, 107	2, 021	50, 054
June.....	152, 602	102, 057	254, 659	1, 859	46, 470
Total.....	870, 000	746, 086	1, 616, 086	1, 732	43, 258

¹ Average for the year.

High daily and monthly records were made by steam shovels as follows:

No. and class of shovel.	High daily record.		High monthly record.	
	Date.	Yardage.	Date.	Yardage.
120 (70-ton Bucyrus).....	Apr. 2.....	3,315	April.....	64,978
257 (model 91, Marion).....	May 2.....	5,554	May.....	84,519

Wet fill was pumped into the dam by pipe-line dredges working in borrow pits upward of $1\frac{1}{2}$ miles distant, the maximum lift of material being 100 feet. For the longer pipe lines and higher lifts, one or two relay pumps were installed to assist the dredges. Material handled by borrow-pit measurement was as follows:

[Cubic yards.]

Month.	Dredge 82.	Dredge 83.	Dredge 84.	Dredge 85.	Dredge 86.	Total.
1911.						
July.....	141,800	178,500	158,600	140,600	.....	619,560
August.....	154,000	179,000	95,047	122,000	.....	550,047
September.....	116,000	210,000	60,000	120,450	4,200	510,650
October.....	160,200	208,400	.....	101,900	161,900	632,400
November.....	114,400	124,370	.....	115,000	230,100	583,870
December.....	147,175	109,615	.....	140,903	184,611	582,304
1912.						
January.....	63,889	182,222	.....	112,537	128,074	486,722
February.....	.....	138,074	.....	180,822	71,648	390,544
March.....	.....	135,756	.....	175,344	139,637	450,737
April.....	.....	120,840	.....	119,226	157,033	397,099
May.....	.....	120,840	.....	120,339	65,406	306,585
June.....	.....	104,377	.....	125,733	32,993	263,103
Total.....	897,464	1,811,994	313,647	1,574,914	1,175,602	5,773,621

Measured in place in the dam, wet fill excavated by dredges shows a loss of 56 per cent, due mainly to waste of soft clay and clay in suspension through drain pipes, minor causes being leakage from pipes and general consolidation. The net wet fill, therefore, amounted to 2,543.086 cubic yards.

Miscellaneous work connected with the construction of the dam included transfer of relay pump outfits as required; maintenance and extension of track system; construction and extension of track and pipe-line trestle; clearing ahead of dredges; stripping and spading subsoil in advance of hydraulic fill; and pipe-line work connected with dredge discharge and drainage systems.

GATUN SPILLWAY.

During the first half of the year construction of the spillway dam was confined to the east and west flanks, where the abutments, ogee, and crest piers were complete to +69, the top of the ogee. Nothing could be done in the central section during the rainy season, this being held at +10, except for the construction piers, to carry the

floods of the Chagres River and avoid flooding the main line of the Panama Railroad. With the beginning of the dry season about two-thirds of the central section were inclosed with a cofferdam, the concrete work therein was carried well above water level, and full closure was then made within a cofferdam covering the balance of the central section. Three Stoney gates and one cylindrical valve were installed to control the flow through the four undersluices. In accordance with the approved program, these gates were closed on April 30 and Gatun Lake began to fill to the preliminary level of +50 above which the water will flow over the central section of the spillway dam until the next dry season, when the concrete work can be carried to completion and the crest gates installed. A trestle has been built from the eastward at +95 and a derrick erected near the west abutment to enable construction work on the east and west flanks to proceed during the first half of next year.

Excavation, including preparation of foundations, is completed in the spillway, and the concrete work is 90 per cent completed. Progress by fiscal years has been as follows:

[Cubic yards.]

Year.	Excavation.	Concrete.
Prior to July 1, 1907	3,832	.....
1907-8.....	938,901	.....
1908-9.....	359,821	30,464
1909-10.....	127,610	53,632
1910-11.....	157,628	59,651
1911-12.....	7,123	58,666
Total.....	1,594,915	202,413

PERMANENT POWER PLANT.

Plans having been approved for the excavation and grading incident to the construction of the spillway hydroelectric power plant, a steam shovel began work in May. Including the grading by steam shovel in August and September, the total excavation amounts to 72,119 cubic yards, making this item about 90 per cent completed.

The following statements show the comparative cost for the dam and spillway for the fiscal year:

Comparative statement of costs, dam and spillway.

[illegible]

Comparative statement of costs, dam and spillway—Continued.

	1911					1912						
	July.	August.	Septem-ber.	October.	Novem-ber.	Decem-ber.	January.	Febru-ary.	March.	April.	May.	June.
GATUN SPILLWAY CONSTRUCTION—continued.												
Masonry—Continued.												
Plant arbitrary.....		\$0.2000	\$0.2000								\$0.0600	\$0.0600
Division expense.....		.0171	.0752								.0122	.0120
Total division cost.....		.5544	1.2747								.2961	.2704
Preparing foundations, excavation, quantities, cubic yards.....	903	742	576	112			1,330	1,228	254		1,130	848
Loading by power.....	\$0.1979	\$0.4177	\$0.4086	\$0.3696				\$0.1506	\$1.1089			
Loading by hand.....	.8956	1.8574	2.0109	4.4843				.6879	1.1215		\$1.1587	\$1.3146
Tracks.....		.0544	.1805								.0114	
Transportation.....	.0410											
Pumps.....												
Maintenance of equipment.....	.2173			.4813				.0065	.0005		.0065	
Coferdams.....	.2680	.8150	.0779	.0089			.8510	.0947	.1884		.0382	.0007
Plant arbitrary.....	.1190	.2986	.2000	.2000			.0600	.0600	.0600		.0600	.0600
Division expenses.....	.1314	.2516	.2195	.3604			.1199	.0508	.0883		.1007	.1416
Total division cost.....	1.8702	3.6947	3.0974	5.9045			2.1146	1.0505	2.5676		1.3755	1.5169
Masonry, reinforced, quantities.....cubic yards.....				168	189	179	82					
Cement.....				\$1.6964	\$1.7778	\$1.7606	\$1.7305					
Stone.....				1.8627	1.7425	2.0417	2.0104					
Sand.....				.8300	.8268	.9292	1.0513					
Mixing.....				.3601	.5010	.3293	.1967					
Wood forms.....				3.1093	3.3780	6.6704	2.1778					
Placing.....				1.0005	1.5958	.6113	.8604					
Reinforcements.....				1.2066	3.3892	1.7606	1.3250					
Maintenance of equipment.....				.2069	.6340	.5544	.3137					
Plant arbitrary.....				.3960	.3960	.3960	.4360					
Division expense.....				.3229	.3156	.3934	.3154					
Total division cost.....				10.9914	14.5567	15.4409	10.4172					
Back filling, quantities.....cubic yards.....	770		5,712		2,951	629						

[illegible]

MUNICIPAL ENGINEERING.

[Mr. Leslie G. Thom, superintendent, in local charge, July 1, 1911, to December 13, 1911.
Mr. George M. Wells, office engineer, in local charge, December 14, 1911, to June 30, 1912.]

GATUN WATERWORKS.

During the year the purification plant at Agua Clara was completed and filtered water turned into the mains on December 29, 1911. The main pipe at the pump station was so arranged as to divide the water main system into two parts, using all mains lying west of the administration building for raw water furnished to plant and equipment and all mains east of the administration building for filtered water for domestic use.

Due to shortage of water at Colon and Toro Point and Porto Bello, it became necessary to transport water in barges from January 25 to May 23 to Toro Point, from May 10 to June 24 to Cristobal, and from May 9 to 16 to Porto Bello.

The average daily consumption exclusively for use at Gatun amounted to approximately 2,500,000 gallons per day. During the time it was necessary to transport water to Cristobal, Toro Point, and Porto Bello this amount was increased to approximately 3,200,000 gallons per day.

The usual work of shifting, relaying, and maintaining miscellaneous pipe lines was carried on and approximately 71,757½ feet of various sizes were handled.

The attached table gives the amount of water filtered and pumped at the Agua Clara pump station from January 1 to June 30, 1912. This does not include raw water:

Agua Clara filters and reservoir.

Month.	Rainfall (inches).	Eleva- tion reser- voir (feet).	Alkalinity (per million).		Coagulant aluminum sulphate (pounds).	Turbidity (per million).		
			Raw.	Filtered.		Raw.	Filtered.	
1912.								
January.....	0.75	60.60	25	28	3,266	30	0	
February.....	2.10	58.20	26	17	3,109	28	0	
March.....	.36	55.00	33	17	2,707	20	0	
April.....	.27	51.25	32	30	3,609	50	0	
May.....	13.47	49.90	35	26	3,697	30	0	
June.....	16.25	54.00	46	26	12,000	20	0	
	33.20				28,388			

Month.	Color (per million).		Odor (per million).		Bacteria (per c. c.).		Wash water (gallons).	Monthly consump- tion (gallons).
	Raw.	Filtered.	Raw.	Filtered.	Raw.	Filtered.		
1912.								
January.....	75	5	0	0	469	129	1,219,280	16,460,280
February.....	70	8	0	0	436	160	1,160,800	15,670,800
March.....	75	8	0	0	469	119	1,515,680	20,461,680
April.....	60	0	0	0	800	150	1,709,120	23,073,120
May.....	35	0	Earthy.	0	550	150	1,603,760	21,650,760
June.....	35	0		0	798	101	1,913,600	25,833,600
							9,122,240	123,150,240

AGUA CLARA RESERVOIR.

The regular maintenance of the banks of the reservoir was continued during the year.

The water in the reservoir began to fall on November 7, 1911, and continued to fall until May 29, 1912, when it reached its lowest elevation of 48.60. There was at this time available for use in the reservoir 171,004,000 gallons of water, or a quantity sufficient for 68 days, at an average daily rate of 2,500,000 gallons per day. The dry season practically began on December 1, and continued until May 13. During this time the water fell from elevation 66.6 to elevation 49.75, or 16.85 feet.

The following table gives the rainfall for each month of the year at this reservoir:

Rainfall, Agua Clara Reservoir.

	Inches.
July -----	8.92
August -----	10.65
September -----	7.56
October -----	16.92
November -----	17.15
December -----	1.45
January -----	.75
February -----	2.10
March -----	.36
April -----	.27
May -----	13.47
June -----	16.25
Total -----	95.85
Daily average -----	.26+

ROADS, SEWERS, AND DRAINS.

The usual maintenance work on roads, sewers, and drains was carried on.

The entire sewer system was flushed on an average of twice each month.

During the year approximately 10,000 square yards of macadam was laid and repaired.

Approximately 15,000 linear feet of road ditches were cleaned.

About 2,800 linear feet of curb and gutter were laid.

About 3,000 feet of sewers were installed.

SANITARY MAINTENANCE.

During the year approximately 336,000 linear feet of sanitary ditches were cleaned; approximately 8,000 linear feet of sanitary ditches were constructed; and approximately 2,300 linear feet of sanitary ditches were lined with concrete.

CRISTOBAL AND COLON.

WATERWORKS.

The pump station and filtration plant at Mount Hope were operated successfully and without any great difficulty, other than the excessive overloading of the filters, until December 18, 1911, at which

time, due to the excessively dry season, it became necessary to install supplementary pumps and boilers at the Mindi diversion in order to reduce the draft on the Brazos Brook Reservoir. This station from this time until the end of the fiscal year furnished approximately 1,000,000 gallons of water per day.

The continued severity of the dry season, resulting in the rapid fall of the water level in the Brazos Brook Reservoir, necessitated certain rearrangements of the pumps in the Mount Hope pump station so that when the water level reached an elevation of approximately 37 feet above sea level it would be possible to pump the water from Brazos Brook into the sedimentation basin. This condition obtained about April 3, and from that date until the end of the fiscal year it was necessary to run this pump, using the main from Brazos Brook to the pump station as a suction line and pump water into the sedimentation basin, from which point it was forced into the mains to Colon by the two remaining pumps.

The level of the water in the Brazos Brook Reservoir reached the critically low stage of 33.2 feet above sea level May 4, at about which time, in order to reduce the draft as much as possible on the reservoir, all mains other than those within the limits of the city of Colon were cut off and water for Cristobal was furnished from Gatun. This water was hauled in barges from the cement shed slip at Gatun to Dock 13, where it was pumped by the tug *Phoenix* into the Cristobal main. The average daily amount furnished in this way from May 10 to June 24 was about 550,000 gallons.

In order to further save consumption of water, the filters at Mount Hope were thrown out of service on April 25, and from this time until June 29, when the filters were thrown back into service, raw water only was furnished.

The usual maintenance and repairs to pipe lines were carried on during the year.

The attached table gives the amount of water pumped and filtered at Mount Hope pump station during the year:

Mount Hope filter and Brazos Brook reservoir.

Month.	Rainfall (inches).	Eleva- tion reser- voir (feet).	Alkalinity (per million).		Coagulant aluminum sulphate (pounds).	Turbidity (per million).	
			Raw.	Filtered.		Raw.	Filtered.
1911.							
July.....	14.03	43.7	17.0	7.0	13,175	15	0
August.....	12.19	43.4	16.0	3.0	15,655	20	0
September.....	10.33	43.0	17.0	2.0	15,750	23	0
October.....	14.43	45.0	18.0	1.0	17,360	20	0
November.....	18.81	49.9	17.0	6.0	12,000	25	0
December.....	1.86	46.2	18.0	5.0	14,260	20	1
1912.							
January.....	.58	43.1	18.0	4.0	18,600	20	0
February.....	2.26	40.6	19.0	7.0	18,125	12	0
March.....	1.25	37.3	18.0	7.0	19,530	15	0
April.....	.81	33.5	18.5	8.0	12,515	20	0
May.....	13.37	32.5	19.0	.....	.....	30	.....
June.....	18.12	35.9	19.2	.....	.....	25	.....
	108.04	.....	.....	.....	156,970	.....	.....

Month.	Color (per million).		Odor (per million).		Bacteria (per cc.).		Wash water (gallons).	Monthly consump- tion (gallons).
	Raw.	Filtered.	Raw.	Filtered.	Raw.	Filtered.		
1911.								
July.....	35	10	0	0	695	68	8,421,120	78,597,120
August.....	27	8	0	0	781	75	8,143,320	76,004,320
September.....	25	4	1 m	1 m	692	109	8,021,880	74,870,880
October.....	38	5	2 D	0	596	116	8,440,200	78,775,200
November.....	35	2	0	0	691	88	8,430,120	78,681,120
December.....	30	20	0	0	598	65	9,149,400	85,394,400
1912.								
January.....	45	5	0	0	476	154	9,551,640	89,148,640
February.....	58	7	0	0	498	179	8,809,200	82,219,200
March.....	30	0	0	0	502	192	9,967,200	93,027,200
April.....	30	0	0	0	900	200	9,767,280	91,161,280
May.....	45	.....	Earthy.	.....	650	.....	7,181,760	67,029,760
June.....	45	.....	0	.....	1,110	.....	6,883,560	64,246,560
	.....	.....	.....	.....	.....	.....	102,766,680	959,155,680

The amount of water being forced through the filtration plant exceeds the maximum capacity by nearly 50 per cent, and this, combined with an inadequate supply of water furnished during the dry season by Brazos Brook and with the unsatisfactory arrangement of the pump station, resulting in practically no fire protection to Colon and Cristobal, requires that immediate steps be taken having in view the providing for an unlimited water supply and the construction of a modern filtration and pump plant.

With this object in view, studies and experiments were made during the year resulting in detailed plans for a general project being developed. This project, together with the plans and estimate of cost, were submitted in May.

BRAZOS BROOK RESERVOIR.

Owing to the constantly increasing draft on the reservoir at all times during the year, and also due to the seepage through the dam, combined with the early commencement of an excessively dry season,

the fall of water began on December 1 and continued until May 17. At the beginning of the dry season the elevation was 48.9, and it reached its maximum low point of 32.2 feet on May 17 and remained at this low point approximately constant until June 2. The water at this stage was only $1\frac{1}{8}$ feet above the top of the lowest outlet pipe, and there remained in the reservoir an available supply of only 36,000,00 gallons.

The average daily amount of water drawn from the reservoir, exclusive of seepage and evaporation, during that period of the year when water was not being hauled from Gatun and the Mindi pump station was in operation, amounted to approximately 3,000,000 gallons per day.

During the year the usual maintenance of the banks of the watershed was carried on, including the clearing of a strip approximately 100 feet wide above the high-water line of the reservoir. A barbed wire fence was constructed around the entire watershed and persons having gardens or small farms within the watershed limits were removed.

COLON IMPROVEMENTS.

Work was continued during the fiscal year according to the approved plans.

The hydraulic fill was completed in August, 1911, and the water and drainage systems were completed, as well as curb and gutter. On June 30 the macadam work was approximately 96 per cent completed, the sewer system 97 per cent completed, and the concrete alleyways 30 per cent. The street fill was 96.5 per cent completed.

During the year 9,826 feet of water mains were laid; 8,265 feet of sewer lines were laid, also 1,338 feet on D Street extension; 1,150 feet of drains were laid; 64,024 square yards of macadam were laid (this includes 3,931 square yards on D Street extension, 19,299 square yards of resurfacing on D Street between Second and Fourteenth Streets, and 1,560 feet of resurfacing on other streets); 20,025 feet of curb and gutter were constructed (this amount includes 949 feet of retaining wall in front of Panama Railroad corral and 2,015 linear feet of replacement) and, in addition to the above, 1,415 linear feet were constructed on the D Street extension. Fourteen thousand three hundred and ten square feet of concrete alleyways were constructed.

TORO POINT.

The necessary maintenance work was carried on throughout the year; 14,577 feet of water main were laid, 316 feet of sewers were laid, and 342 cubic yards of material were excavated at the reservoir.

Owing to leakage of the reservoir and the unusually dry season, it was necessary to haul water in clapnets to supplement the diminishing supply of the stream. About the middle of February the stream stopped flowing and it was necessary to haul all water used from then on until the latter part of May. Salt water was supplied by a steam pump for the range closets, etc.

TRANSPORTATION.

The following is a list of the equipment in the transportation service of the Atlantic division June 30, 1912:

Standard-gauge equipment:

American locomotives	18
French, Roger type, and old Panama R. R. locomotives	13
Wrecking crane, No. 64	1
Track shifters	2
Steel flat cars	28
Wood flat cars, 40-ton Lidgerwood	25
Oliver dump cars—	
12-yard	5
18-yard	202
Western dump cars—	
12-yard	13
18-yard	126
Spreaders	3
Unloaders	2
Pile drivers	6
Motor car	1

Narrow-gauge equipment:

Locomotives—	
3-foot 6-inch gauge	10
3-foot gauge	9
Narrow-gauge flat cars—	
3-foot 6-inch gauge	13
3-foot gauge	43
Dump cars, 3-foot gauge	8
4-yard dump cars, 3-foot gauge	30
6-yard dump cars, 3-foot 6-inch gauge	57

Respectfully submitted.

WM. L. SIBERT,
Lieutenant Colonel, Corps of Engineers, U. S. Army,
Member of Isthmian Canal Commission,
Division Engineer, Atlantic Division.

Col. GEORGE W. GOETHALS, U. S. Army,
Chairman and Chief Engineer,
Culebra, Canal Zone.

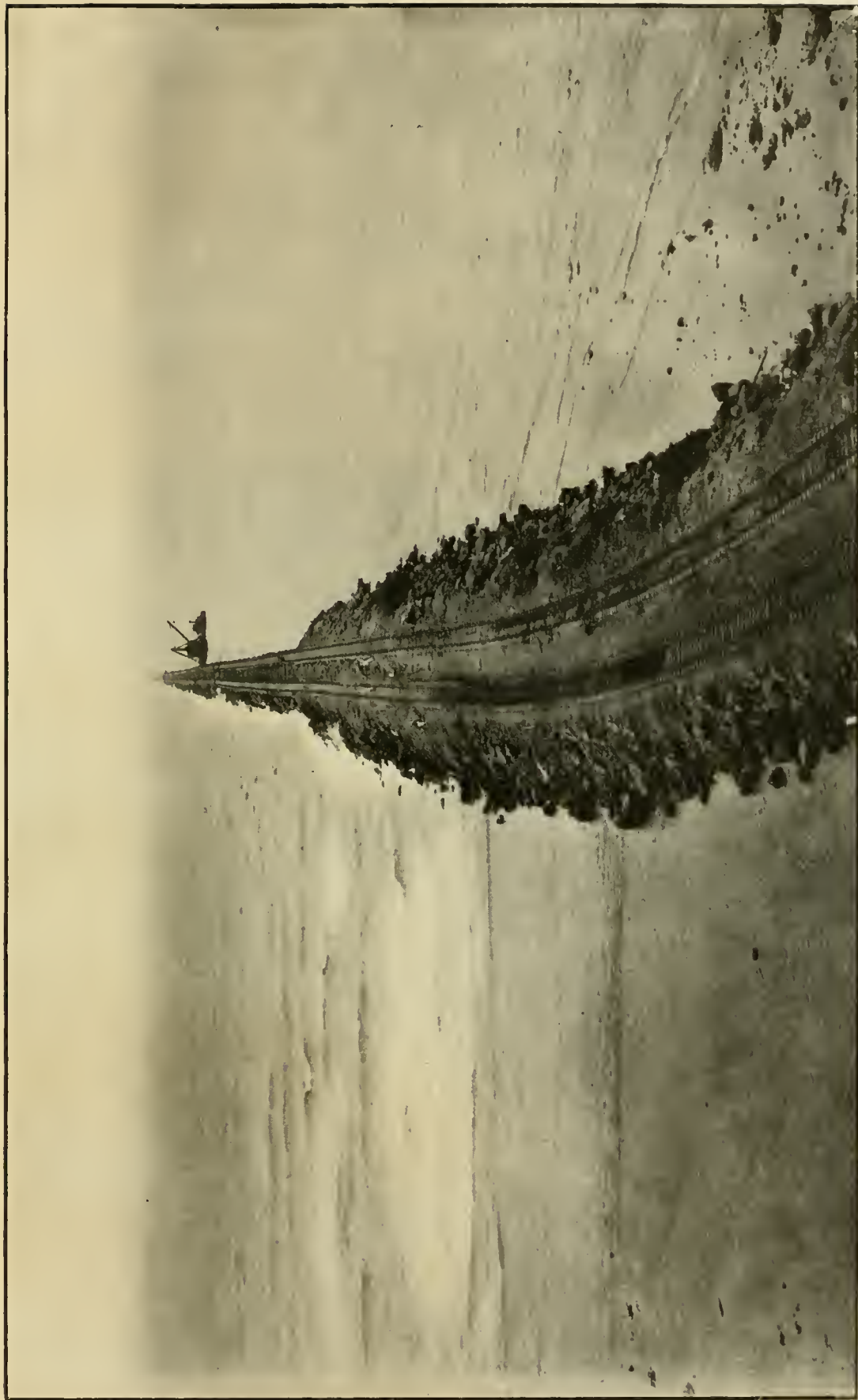
APPENDIX TO APPENDIX B.

Progress report for fiscal year 1911-12, Atlantic division.

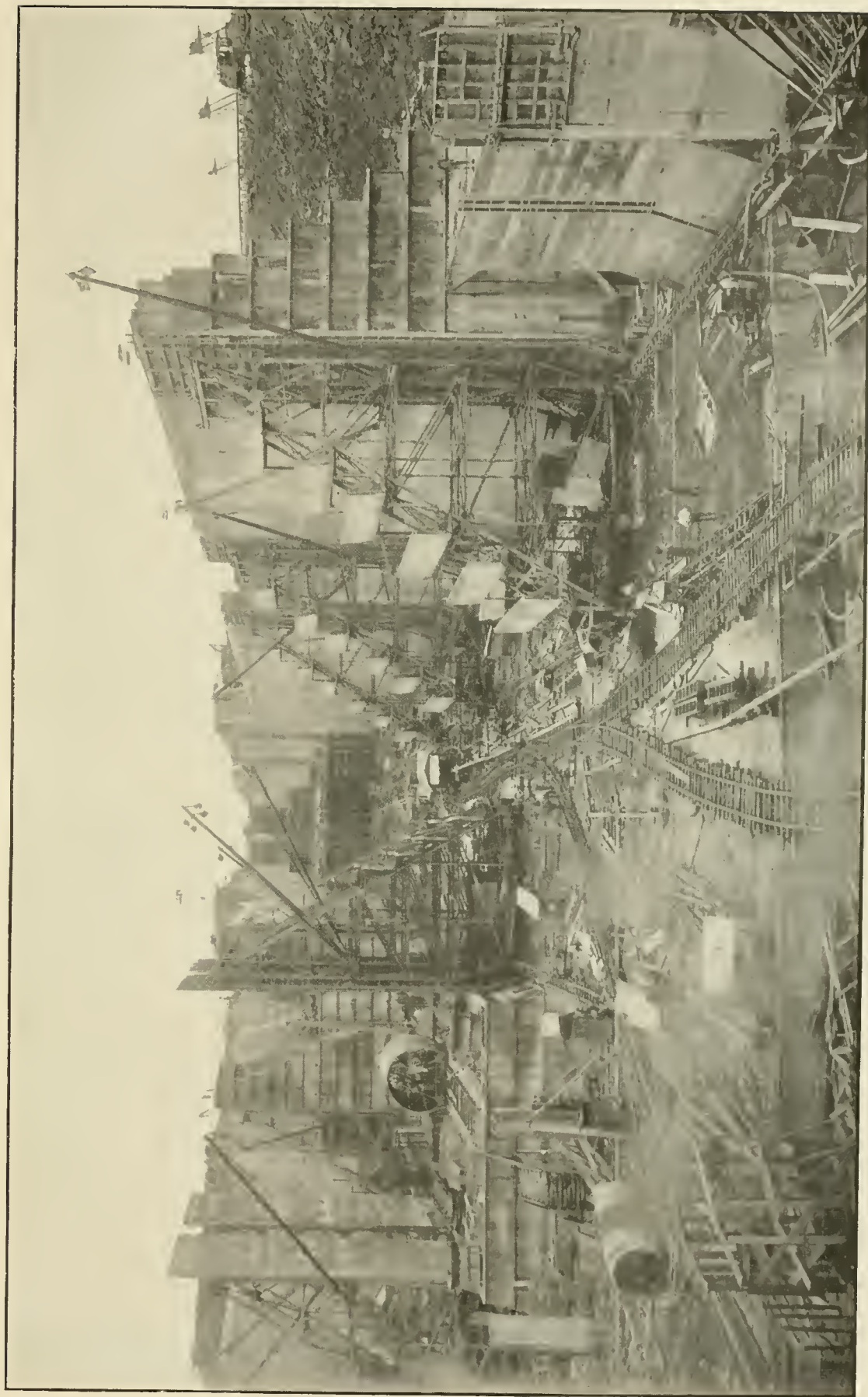
	Locks.	Dam and spillway.	Mindi.	Dredging.	Porto Bello.	Nombre de Dios.	Municipal engineering.	Break-water.	Total.
Steam-shovel excavation:									
In prism.....	8,888	76,684	425,872						511,444
Auxiliary.....	127,200								127,200
Dredge excavation:									
In prism.....	289,310			5,030,445					5,319,755
Auxiliary.....				568,680					568,680
Total excavation.....	425,398	76,684	425,872	5,599,125					6,527,079
Explosives used.....	40,157	334,16	96,376	131,20	183,23	0.05	12.88	94.48	892,533
Power drilling.....	4,435	18,932	102,170	36,266	159,992			22,223	344,018
Hand drilling.....	143,089	35,013	73,688						251,790
New track laid.....	35,059	52,710	21,031		42,602			13,373	164,775
Material placed in dams.....		5,212,705							5,212,705
Cement received.....	448,701	57,546					2,686		508,933
Cement used.....	501,258	62,886					2,928.5		567,072.5
Cement on hand July 1, 1912.....	9,041	3,933					4		12,978
Stone received.....	394,855	51,178					14,331		460,364
Stone used.....	381,995	49,126					14,393		445,514
Stone on hand July 1, 1912.....	169,879	700					150		170,729
Sand dredged.....		40,531				144,123			184,654
Sand received.....	184,297	29,171					1,032		214,500
Sand used.....	206,559	25,631					1,032		233,222
Sand on hand July 1, 1912.....	45,177	4,067					61		49,305
Rock crushed.....					440,413				440,413
Concrete placed.....		58,666							511,231
Lumber used.....	451,025						1,540		10,690,528
Forms, steel, erected.....	9,711,438						85,143	893,947	8,555.7
Forms, wooden, erected.....	8,555.7								2,274,515
Steel work placed.....	2,269,122						5,393		3,179.2
New roads built.....	3,179.2								19,172
Water mains laid.....									83,237
Sewers laid.....									16,915
Open drains and ditches dug and cleaned.....			2,290				407,127		409,417
Average daily force employed.....	2,601	1,488	1,276.6	1,317.1	463.08	271.5	344.6	267.08	6,828.96

19 months.

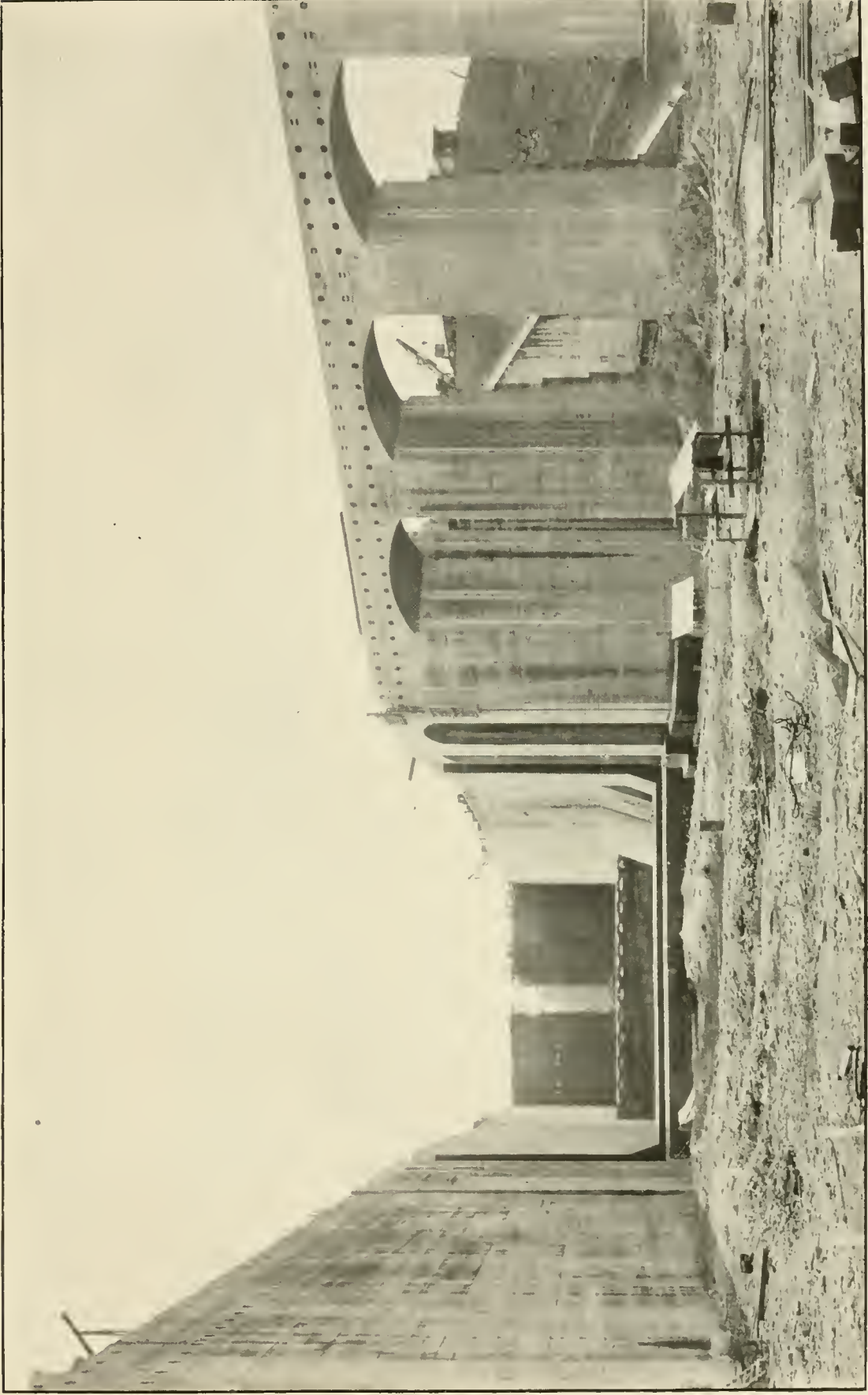
22 months.



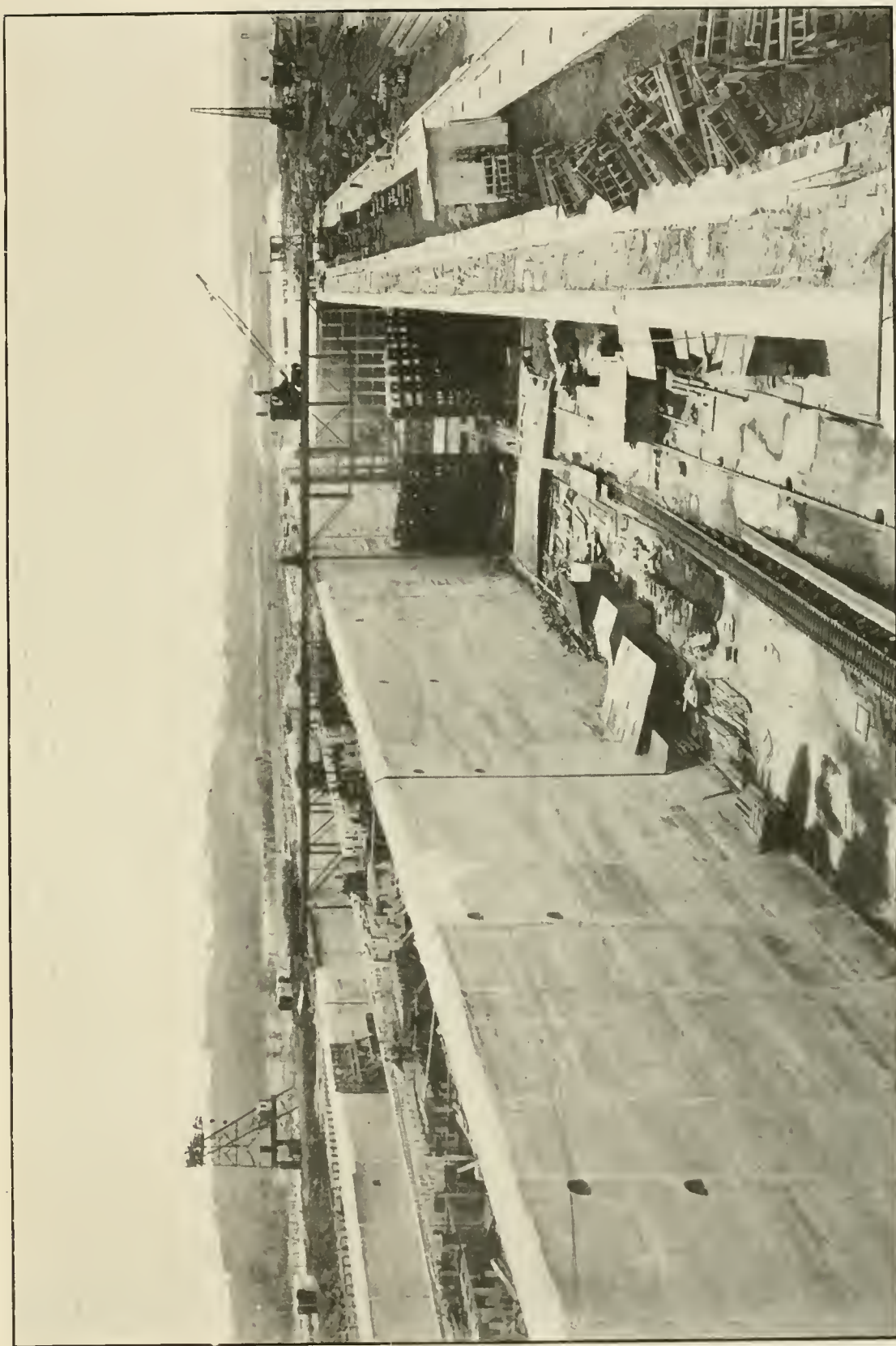
WEST BREAKWATER, LOOKING SEAWARD FROM TORO POINT, SHOWING DREDGE AT WORK PLACING ROCK ON FACE OF BREAKWATER. JUNE, 1912.



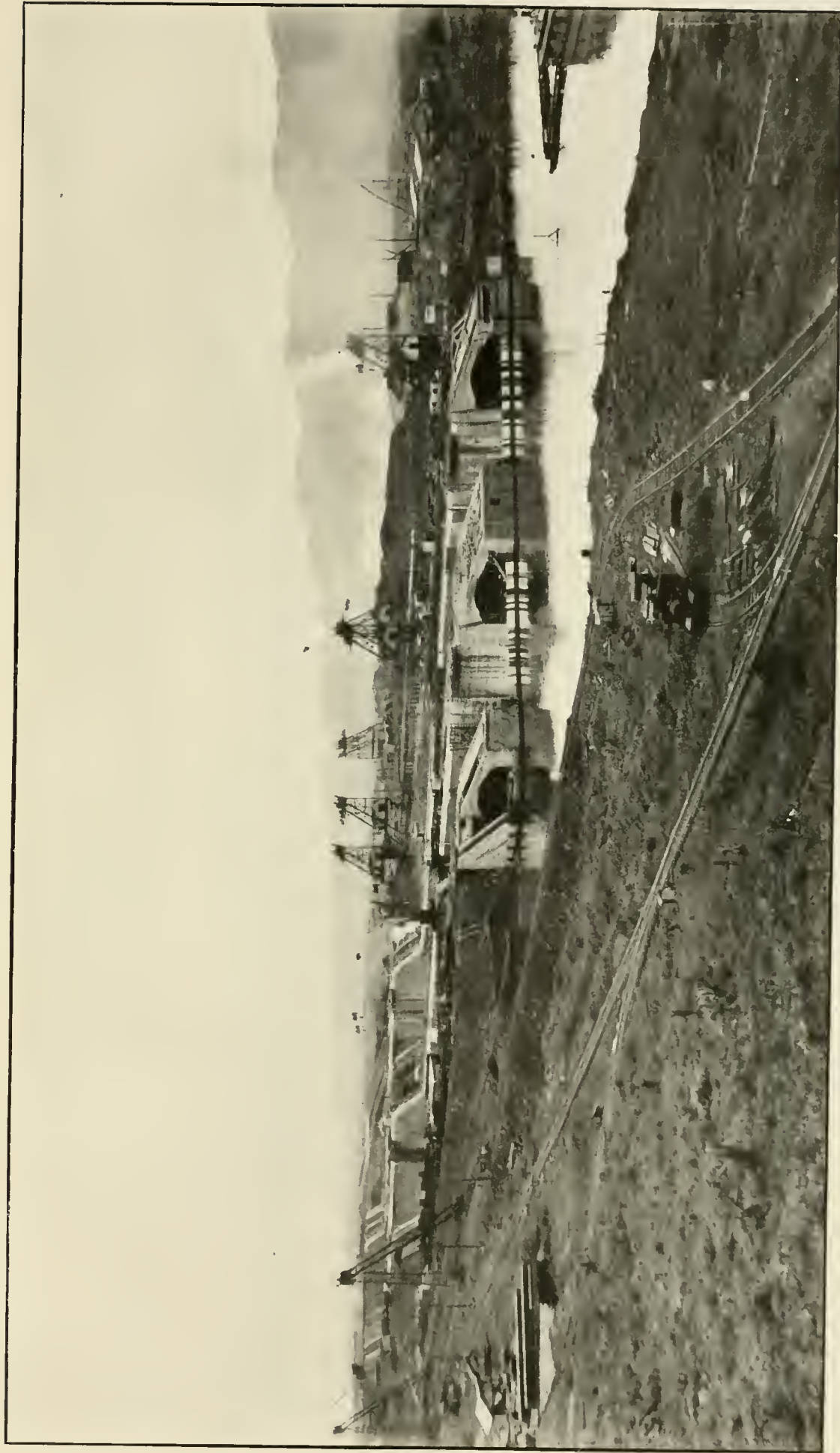
GATUN LOWER LOCKS LOOKING SOUTH FROM COFFERDAM, SHOWING WEST CHAMBERS OF UPPER AND MIDDLE LOCKS.
NOVEMBER 9, 1911.



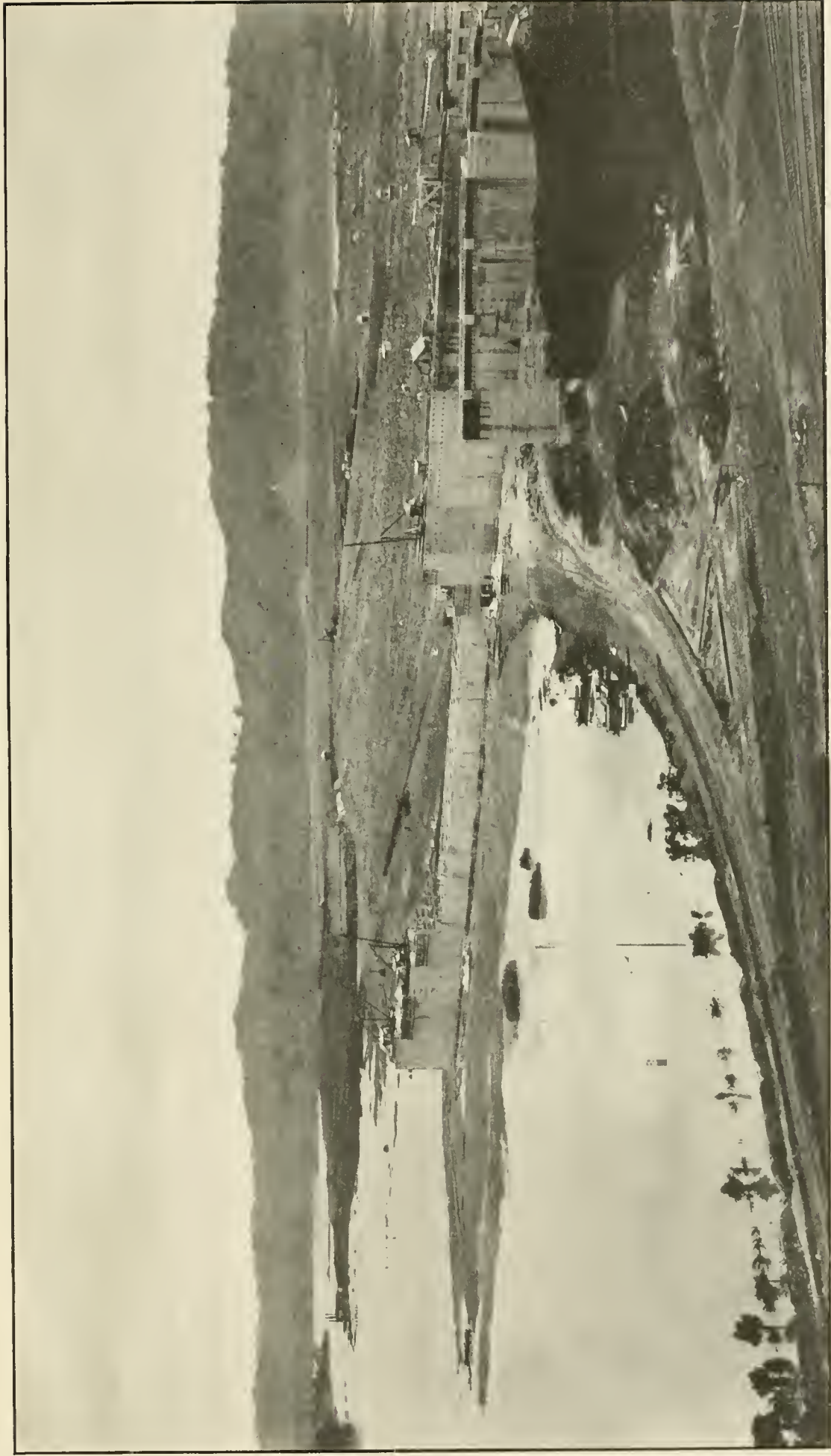
GATUN LOCKS FOREBAY, EAST SIDE LOOKING NORTH, SHOWING FLARING APPROACH WALL. JUNE 7, 1912.



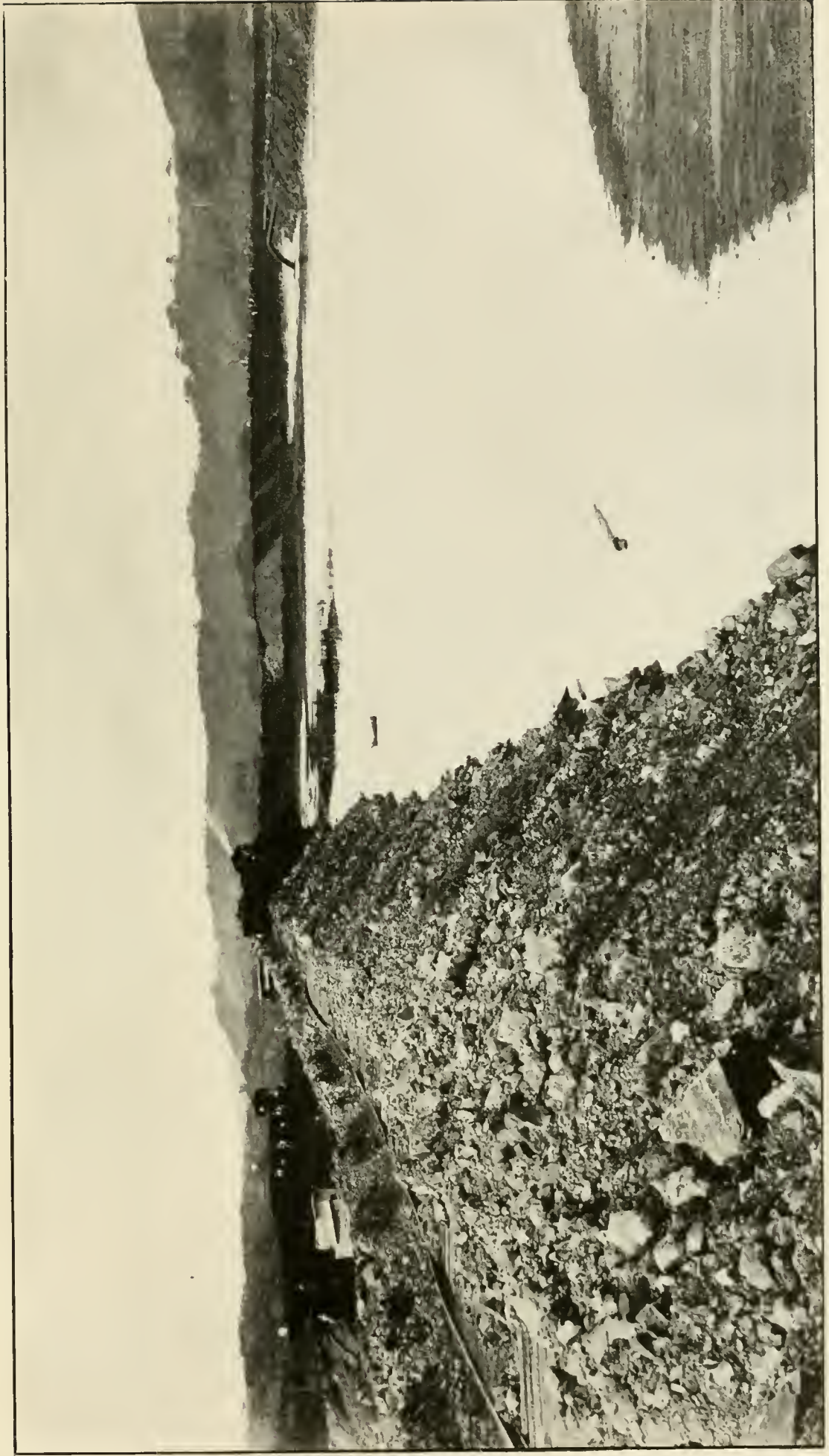
GATUN LOWER LOCK, EAST CHAMBER, LOOKING NORTH, SHOWING TEMPORARY COFFERDAM AT EXTREME END OF LOCK CHAMBER. JUNE 12, 1912.



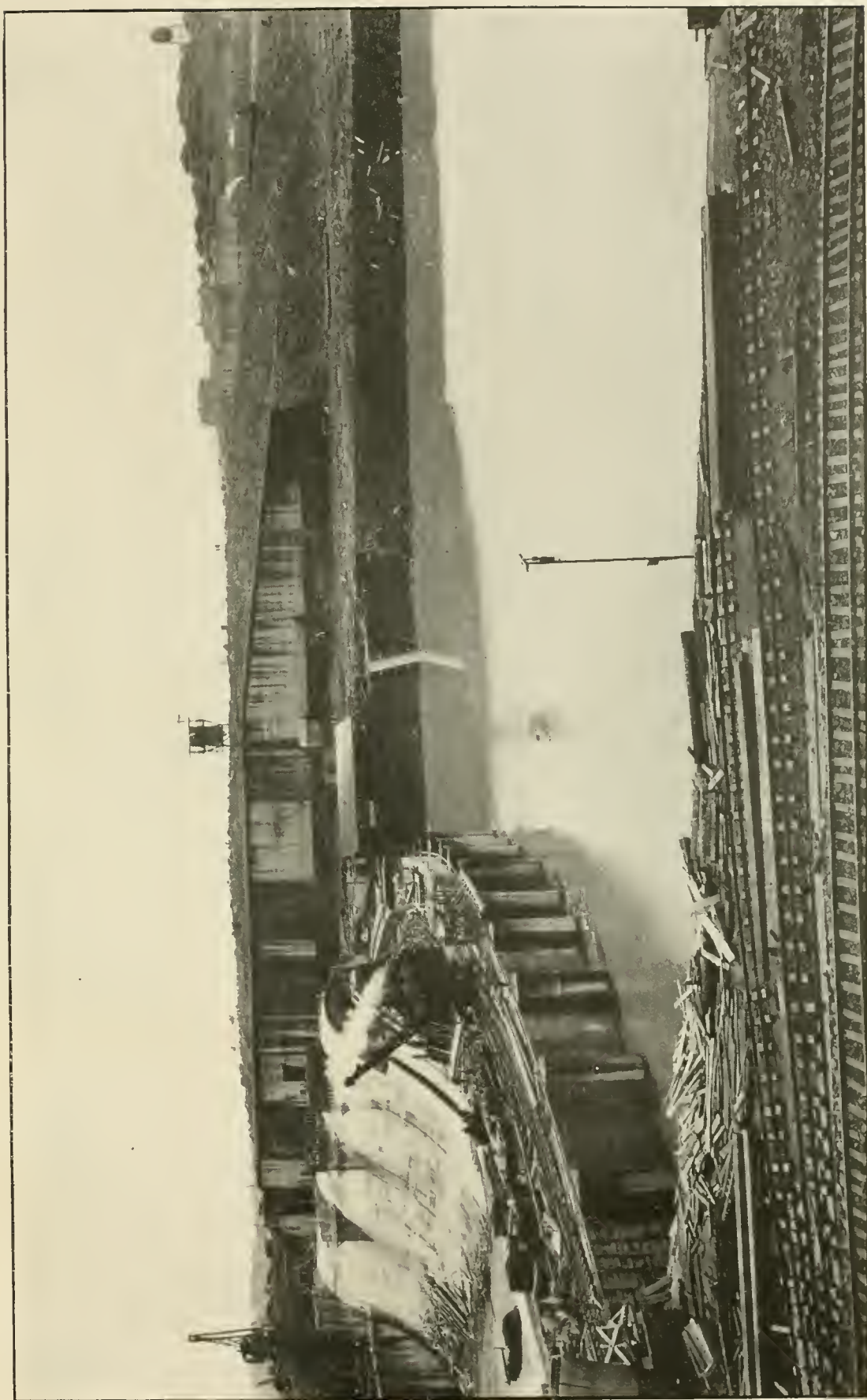
GATUN LOCKS. GENERAL VIEW LOOKING SOUTHWEST. SHOWING NORTH END OF THE LOCKS, WITH TEMPORARY COFFERDAM IN PLACE.
JULY 2, 1912.



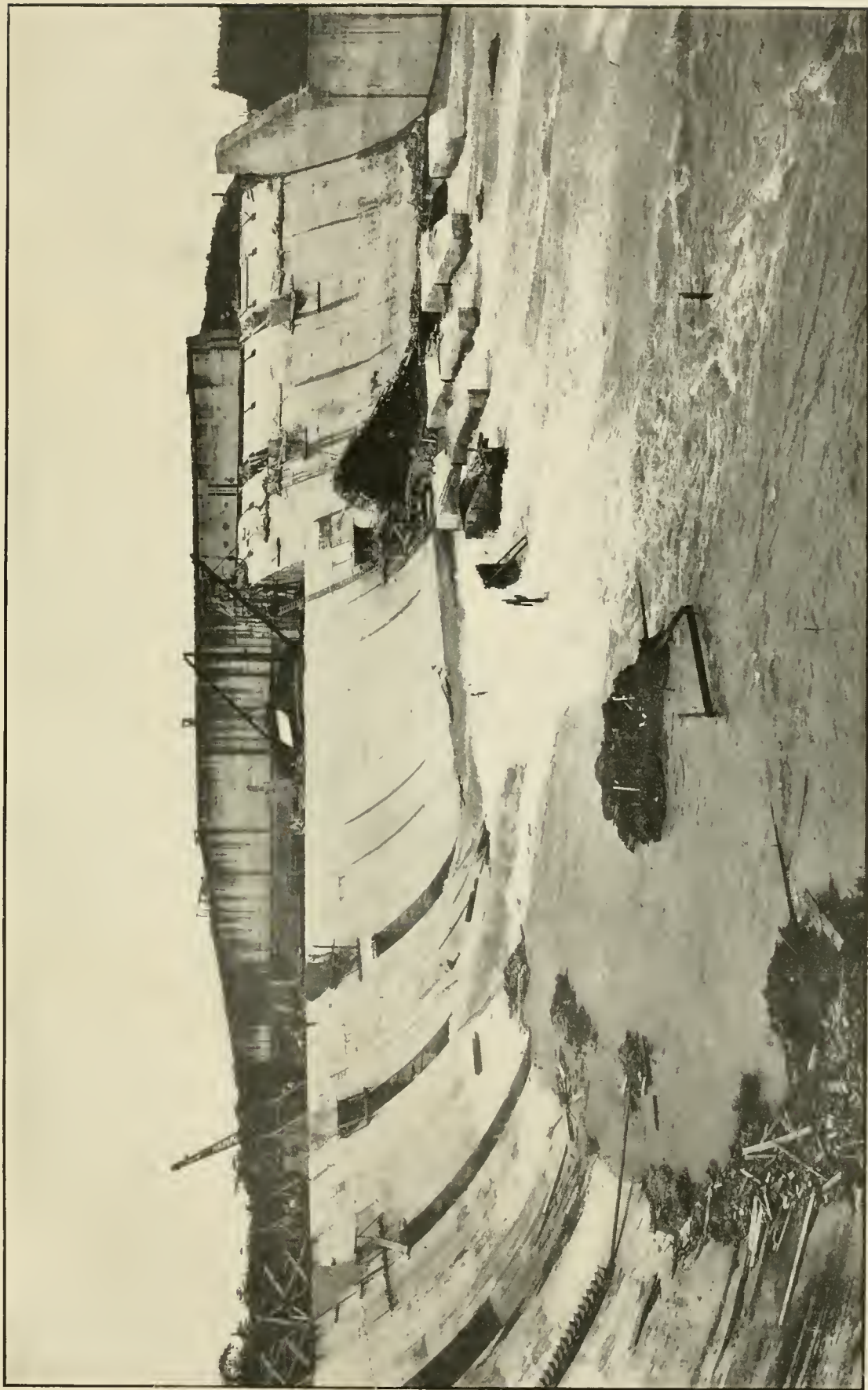
GATUN LOCKS AND DAM, LOOKING WEST FROM WATER TOWER, SHOWING SOUTH CENTER APPROACH WALL AND FOREBAY OF GATUN LOCKS, WITH DAM AND SPILLWAY IN THE DISTANCE. JUNE, 1912.



GATUN DAM. WEST SECTION OF DAM LOOKING WEST, SHOWING PROGRESS OF HYDRAULIC FILL. JUNE 12, 1912.



GATUN SPILLWAY LOOKING EAST TOWARD LOCKS, SHOWING UP AND DOWN STREAM FACES OF OGEE DAM. JUNE 6, 1912.



GATUN SPILLWAY LOOKING SOUTHWEST, SHOWING DOWNSTREAM FACE OF OGEE DAM. JUNE 6, 1912.

APPENDIX C.

REPORT OF LIEUT. COL. D. D. GAILLARD, CORPS OF ENGINEERS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, DIVISION ENGINEER, CENTRAL DIVISION.

ISTHMIAN CANAL COMMISSION, OFFICE OF DIVISION ENGINEER, CENTRAL DIVISION, *Empire, Canal Zone, July 20, 1912.*

SIR: I have the honor to submit the following report of operations in the central division for the fiscal year ended June 30, 1912.

The central division extends from the south toe of Gatun Dam to the north end of the lock site at Pedro Miguel, a total distance along the axis of the canal of 31.69 miles, and embraces the entire extent of the former Culebra and Chagres divisions, which are now known as the Culebra and Chagres sections of the central division.

The total amount of material excavated in the above territory during the fiscal years ended June 30, from 1904-1912, is given in the following tables:

FROM CANAL PRISM.

Fiscal year ended June 30—	Earth.	Rock.	Total.	Percent rock.
	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	
1904.....	24,024	36,083	60,107	60.03
1905.....	397,043	344,601	741,644	46.46
1906.....	764,327	742,235	1,506,562	49.27
1907.....	2,288,199	3,282,233	5,570,432	58.92
1908.....	5,078,864	8,380,514	13,459,378	62.27
1909.....	6,151,152	12,291,472	18,442,624	66.65
1910.....	4,570,728	13,235,383	17,806,111	74.33
1911.....	4,530,568	13,949,074	18,479,642	75.49
1912.....	2,702,228	14,335,050	17,037,278	84.14
Total.....	26,507,133	66,596,645	93,103,778	71.53

FROM OBISPO DIVERSION.

1907.....	128,001	45,221	173,222	26.11
1908.....	240,063	73,448	313,511	23.43
1909.....	293,745	329,535	623,280	52.87
1910.....	26,066	.....	26,066	.....
1911.....	25,684	17,366	43,050	40.00
1912.....	26,168	.....	26,168	.....
Total.....	739,727	465,570	1,205,297	38.63

OUTSIDE WORK.

1907.....	13,520	10,840	24,360	44.50
1908.....	64,233	2,140	66,373	3.22
1909.....	.....	1,873	1,873	100.00
1910.....	33,631	.....	33,631	.....
1911.....	27,467	2,485	29,952	8.30
1912.....	71,269	8,352	79,621	10.00
Total.....	210,120	25,690	235,810	10.89

TOTAL EXCAVATION, INCLUDING ACCESSORY WORK.

Fiscal year ended June 30—	Earth.	Rock.	Total.	Per cent rock.
	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	
1904.....	24,024	36,083	60,107	60.03
1905.....	397,043	344,601	741,644	46.46
1906.....	764,327	742,235	1,506,562	49.27
1907.....	2,429,720	3,338,294	5,768,014	57.88
1908.....	5,383,160	8,456,102	13,839,262	61.10
1909.....	6,444,897	12,622,880	19,067,777	66.29
1910.....	4,630,425	13,235,383	17,865,808	74.08
1911.....	4,583,719	13,968,925	18,552,644	75.29
1912.....	2,799,665	14,343,402	17,143,067	83.67
Total.....	27,456,980	67,087,905	94,544,885	70.96

The amount of material removed during each month since the United States assumed control in May, 1904, is shown graphically on plate 82.

The following table shows the amount (place measurement) of material excavated monthly in the central division during the fiscal year ended June 30, 1912:

[Cubic yards.]

Month.	From canal prism.			Total, including accessory works.		
	Earth.	Rock.	Total.	Earth.	Rock.	Total.
1911.						
July.....	158,901	1,201,216	1,360,117	158,901	1,201,216	1,360,117
August.....	191,485	1,272,809	1,464,294	191,485	1,272,809	1,464,294
September.....	274,914	1,086,531	1,361,445	274,914	1,086,531	1,361,445
October.....	186,081	1,133,106	1,319,187	189,482	1,133,106	1,322,588
November.....	123,437	1,098,309	1,221,746	126,487	1,098,309	1,224,796
December.....	164,252	1,197,639	1,361,891	164,252	1,197,639	1,361,891
1912.						
January.....	232,587	1,211,805	1,444,392	241,035	1,211,805	1,452,840
February.....	176,703	1,239,011	1,415,714	188,745	1,239,611	1,428,356
March.....	350,348	1,361,877	1,712,225	374,100	1,362,677	1,736,777
April.....	315,871	1,284,908	1,600,779	362,615	1,291,860	1,654,475
May.....	230,412	1,187,872	1,418,284	230,412	1,187,872	1,418,284
June.....	297,237	1,059,967	1,357,204	297,237	1,059,967	1,357,204
Total.....	2,702,228	14,335,050	17,037,278	2,799,665	14,343,402	17,143,067

The total amount of material excavated in the central division during the fiscal year—17,143,067 cubic yards—has been exceeded during three previous fiscal years—1909, 1910, and 1911—but during these fiscal years a large amount of excavation was done in the Chagres section of the central division and on the Obispo diversion, both of which works were practically completed prior to the commencement of the fiscal year ended June 30, 1912, leaving the Culebra section (commonly known as the Culebra Cut) as the only remaining part of the work on which excavation was prosecuted to full capacity throughout the year. The total amount of material removed from the Culebra section during the fiscal year—16,476,769 cubic yards—is the largest annual output from this section of the work since the commencement of operations by the United States.

The maximum monthly amount of material excavated in the central division during the fiscal year just closed aggregated 1,712,225

cubic yards, removed in March, 1912. As stated in the last annual report, the output of March, 1909, will undoubtedly remain the highest reached during the construction of the canal, as the work has now reached such a stage that the Chagres section is completed, except for a small amount of dredging, and the north half of the Culebra section is so nearly completed that in a few months practically all operations will be confined to the south half of this section.

The maximum monthly amount of material removed from the canal prism since the commencement of operations was 2,012,469 cubic yards, excavated in March, 1911. The maximum yearly amount of material removed from the canal prism was excavated during the fiscal year ending June 30, 1911, amounting to 18,479,642 cubic yards.

Of the total amount of material excavated during the fiscal year, 16,903,298 cubic yards were removed by steam shovels, 92,656 cubic yards by locomotive cranes equipped with orange peel buckets, 1,329 cubic yards by hand, and 145,784 cubic yards by contractors.

The material excavated by steam shovels is carried by dirt trains to dumps situated from 1 to 36 miles from the place of loading, the average haul varying from 10 to 12 miles.

Had there been no slides or breaks in the banks, i. e., had these banks stood at the assumed slope, the total amount of excavation necessary to complete the canal within the limits of the central division, including the construction of the diversion and other accessory works, would have been 86,293,425 cubic yards. This amount of material had been excavated in the central division by the middle of January, 1912, or in 7.7 years after the United States assumed control of the Canal Zone, and of the entire amount all except 5,881,849 cubic yards had been excavated since April 1, 1907.

REVISED ESTIMATE OF THE QUANTITY OF MATERIAL YET TO BE REMOVED.

A revised estimate of the quantity of material to be excavated in the central division after June 30, 1912, in order to complete the canal is given in the table below. This estimate gives an increase of 4,614,925 cubic yards over the estimate submitted in the last annual report. The details of the new estimate are given in the following table:

[Cubic yards.]

Location.	Districts.				
	Chagres.	Empire.	Culebra.	Pedro Miguel.	Total.
Inside prism lines.....	56,000	2,472,311	5,649,667	606,562	8,184,540
Slides.....		847,000	2,748,000		3,595,000
Drainage cut.....		50,000	75,000		125,000
Silting, Chagres River.....	95,000				95,000
Obispo diversion.....		15,000			15,000
Total.....	151,000	3,384,311	7,872,667	606,562	12,014,540

This very considerable increase, which is nearly as great as that of the preceding fiscal year, was due to the development of new slides as the depth increased, and to the increase in area of slides already

existing at the beginning of the fiscal year. In addition, all excavation along the upper portion of the banks of the canal where slides had developed, or were anticipated, being entirely outside of the canal prism, has been properly included in material removed on account of breaks and slides; and as this work was vigorously prosecuted during the fiscal year by from 6 to 7 shovels, the quantity of material removed by them, as a preventative measure against slides and breaks, was quite considerable.

Although the estimated yardage remaining has been materially increased by the new estimate just described, yet there is no reason to believe that either the ultimate time of completion of excavation in the central division, or the ultimate cost of all excavation in this division, as submitted in the estimate of September, 1908, will be increased, for the reason that since that estimate was submitted the unit cost of excavation in the central division has been materially decreased and the average monthly output has been much in excess of the quantity then estimated.

Taking the revised estimate as a basis, there had been removed up to and including June 30, 1912, within the limits of the central division, 94,401,681 cubic yards, and there remained to be removed 12,014,540 cubic yards, or less than 12 per cent to complete all excavation within the limits of the central division. Of this amount 11,863,540 cubic yards are in the Culebra Section and 151,000 cubic yards in the Chagres Section.

BLASTING.

The total amount of blasted material excavated during the fiscal year was 12,862,968 cubic yards, which was 1,190,727 cubic yards more than in the previous year.

During the year, 150 well or mechanical churn drills and 230 tripod rock drills were in operation.

The number of linear feet of holes drilled during the year was as follows:

Kind of drilling.	Linear feet.	Miles.
Tripod rock drills.....	2,368,804	448.64
Well drills.....	2,243,194	424.84
Hand drills.....	243,302	46.08
Total.....	4,855,300	919.56

The average number of feet drilled per day per tripod rock drill was 41 feet, at an average operating labor cost of 8.96 cents per linear foot.

The average number of feet drilled per day per well drill was 50 feet, at an average operating labor cost of 6.68 cents per foot.

The cost of drilling during the last fiscal year shows a decrease owing to the adoption of a bit for well drills sharpened in such a manner as to increase the efficiency of the drills; also to the concentration of the forces engaged in the sharpening of drill steel, to the abolishment of small shops, and to close supervision of cost sheets of drill work.

In drilling for one shovel cut in the hardest trap rock in the Culebra Cut, 21 tripod rock drills accomplished 6,297 linear feet in 13½ days of nine hours each, or an average of 22 feet per drill per day. These figures are based on the time the drills were actually in operation, and does not include time used in mucking or setting up machinery.

The quantity of explosives used during the year amounted to a total of 2,600.3 gross tons, which was 37.3 gross tons less than the amount used during the previous fiscal year. Of this amount, 2,381,530 pounds were saltpeter dynamite of 60 per cent nitroglycerin, 3,407,738 pounds saltpeter dynamite of 45 per cent nitroglycerin, and 37,400 pounds Trojan powder.

The average number of vertical holes fired per day during the year was 600, having an average depth of 19 feet. An average of 24 pounds of explosives was used per hole.

The average number of toe holes, i. e., holes drilled horizontally, or nearly so, at the foot of a bank to secure greater breaking of the material above, was 100, having an average depth of 15 feet. An average of 30 pounds of explosives was used per hole.

During the year 31,227 "dobe" shots, or "mud caps," were fired in blasting material ahead of steam shovels not broken by the explosives used in the drill holes, and in grading for track work, for which purpose 211,030 pounds of explosives were used.

The average number of pounds of explosives used in each "dobe" shot was 6.76, at an average cost per shot for explosives and blasting material of 90 cents.

The average number of cubic yards of material broken up per pound of explosive was 2.21.

The following blasting materials were used in connection with the dynamite:

Detonators.....	240, 219
Tape, fuse.....feet	673, 378
Electric fuses:	
10-foot.....	1, 800
16-foot.....	6, 700
20-foot.....	58, 500
24-foot.....	145, 700
25-foot.....	9, 200
30-foot.....	210, 002
35-foot.....	162, 930
40-foot.....	73, 575
50-foot.....	22, 870
60-foot.....	200
80-foot.....	56
Tape, insulating.....pounds	4, 575
Wire, connecting.....do	192
Wire, lead.....feet	781, 700

The same stringent rules covering the handling, storing, and use of explosives in effect during previous fiscal years were followed during the last year, the distribution of explosives being under the direct charge of a supervisor and always handled by the same engine and train crew.

All shooting, with the exception of "dobe" shots, is done by experienced blasting wireman using current from the electric-power station at Empire. Occasionally "dobe" shots are fired by the current, but a majority are exploded by the use of detonators and safety fuse.

During the past year over 5,800,000 pounds of explosives were used, and five men were killed while handling dynamite.

Owing to the great care taken to prevent accidents, but eight men in all have been killed by dynamite in the central division during the last three fiscal years, although during that period nearly 19,000,000 pounds of explosives were used.

STEAM SHOVELS.

The total number of steam shovels assigned to the central division at the close of the year was 46. These shovels were of the following sizes :

Class of shovel.	Capacity of dipper.	Number in service.
	<i>Cubic yds.</i>	
45-ton Bucyrus.....	13 ³ / ₄	2
70-ton Bucyrus.....	3	7
95-ton Bucyrus.....	5	20
95-ton Bucyrus.....	4	10
Model 91, Marion.....	5	7

One shovel was completely destroyed and another had to be entirely rebuilt during the year on account of being buried in slides.

The highest daily, monthly, and annual records for shovels of each class are given in the table below :

Record.	45-ton Bucyrus.	70-ton Bucyrus.	95-ton Bucyrus.	Model 60, Marion.	Model 91, Marion.
Date of high daily record....	Feb. 5, 1908	Mar. 14, 1912	Mar. 22, 1910	Apr. 18, 1908	Jan. 21, 1909
Yardage, high daily.....	1,356	2,900	4,465	1,704	3,485
Shovel No.....	58	128	213	152	265
Date, high monthly record....	July, 1908	March, 1909	March, 1910	March, 1908	August, 1908
Yardage, high monthly.....	25,713	53,043	70,290	41,219	55,419
Shovel No.....	59	122	213	152	256
Number of days at work.....	26	27	26	26	25
High annual record.....	105,740	300,872	543,481	.....	441,927
Shovel No.....	54	122	208	.....	264
Number of days at work.....	131	254	295	.....	299

The following table shows the average performance of steam shovels for each month of the fiscal years ended June 30, 1908, 1909, 1910, 1911, and 1912:

Month.	Num-ber of work- ing days.	Cubic yards output per shovel.				Inches rainfall at—		
		Per day.	Per month.	Per hour.		Bas Obispo.	Empire.	Culebra.
				Under steam.	At work.			
1907.								
July.....	26	683.1	17,670	89.5	167.8	8.25	9.89	9.31
August.....	27	719.5	19,428	93.6	164.6	12.69	11.24	11.81
September.....	24	818.2	19,636	105.9	184.7	14.71	10.86	11.38
October.....	27	791.9	21,385	100.5	176.8	13.62	15.44	15.27
November.....	24	773.3	18,562	89.9	170.6	9.85	10.40	6.91
December.....	25	922.3	23,057	120.7	192.2	2.26	1.47	2.30
1908.								
January.....	26	1,039.5	27,031	131.2	208.4	.20	.75	.91
February.....	24	1,112.1	26,690	142.2	215.6	.11	.00	.01
March.....	26	1,150.4	30,146	147.2	221.6	.41	.41	.13

Month.	Number of work- ing. days.	Cubic yards output per shovel.				Inches rainfall at—		
		Per day.	Per month.	Per hour.		Bas Obispo.	Empire.	Culebra.
				Under steam.	At work.			
1908.								
April.....	25	1,191.1	29,780	152.9	230.6	1.81	1.36	1.67
May.....	25	905.7	22,618	115.2	201.4	13.18	12.91	12.43
June.....	26	1,011.2	26,294	130.6	210.5	6.55	8.21	8.86
Fiscal year 1908..	305	931.9	23,685	121.4	199.1	83.64	82.94	80.99
1908.								
July.....	26	1,073.2	27,902	137.9	206.9	9.14	11.79	13.23
August.....	26	1,119.6	29,300	144.7	216.2	10.23	8.11	7.58
September.....	25	1,180.2	29,585	140.8	202.9	5.76	9.75	15.18
October.....	27	1,185.3	32,228	148.3	214.1	9.42	8.85	8.91
November.....	23	1,154.8	26,693	145.8	222.5	6.95	4.46	5.26
December.....	26	1,210.5	31,474	151.8	232.4	6.63	5.09	4.40
1909.								
January.....	25	1,183.0	29,575	148.3	225.8	2.59	2.28	2.96
February.....	23	1,260.4	29,342	157.7	246.8	4.72	1.50	2.46
March.....	27	1,327.2	35,835	167.5	258.5	.45	.21	.15
April.....	25	1,283.7	32,120	160.9	242.5	5.90	3.33	2.56
May.....	25	1,182.9	29,507	148.5	229.3	12.98	7.84	9.44
June.....	26	1,242.9	32,315	156.3	240.5	11.71	7.72	7.36
Fiscal year 1909..	304	1,198.9	30,371	150.4	227.6	86.48	70.94	79.49
1909.								
July.....	26	1,206.9	31,379	152.1	238.8	11.59	8.27	7.95
August.....	26	1,132.8	29,668	142.0	218.9	7.03	7.20	8.32
September.....	25	1,248.3	31,208	156.3	239.8	7.90	7.22	8.40
October.....	26	1,230.1	32,679	154.1	237.0	16.98	21.13	17.70
November.....	24	1,161.3	27,875	147.8	223.9	28.41	21.08	24.46
December.....	26	1,114.6	28,982	141.9	224.9	12.33	9.44	10.58
1910.								
January.....	25	1,252.3	31,307	159.5	238.5	1.24	.70	1.31
February.....	23	1,272.8	29,274	161.6	224.1	1.80	.76	.93
March.....	26	1,388.0	36,090	176.8	260.2	3.12	1.60	1.36
April.....	26	1,295.2	33,674	163.8	291.5	3.85	4.24	5.35
May.....	25	1,263.8	31,596	172.3	276.8	11.09	11.08	10.50
June.....	26	1,229.2	31,962	156.2	238.2	12.08	10.17	11.16
Fiscal year 1910..	304	1,231.0	31,185	155.8	236.1	117.42	102.89	108.02
1910.								
July.....	25	1,231.4	30,786	156.8	231.4	17.00	12.60	16.38
August.....	27	1,330.1	30,224	168.1	242.5	10.66	10.08	10.11
September.....	25	1,340.2	33,505	169.7	244.2	12.24	8.99	10.09
October.....	26	1,294.2	33,649	163.3	237.0	12.90	12.57	13.51
November.....	24	1,225.2	29,403	153.6	228.4	16.90	8.85	10.81
December.....	26	1,170.2	30,424	149.4	228.3	13.11	9.06	11.86
1911.								
January.....	25	1,330.0	33,251	167.7	236.7	.11	.02	.02
February.....	23	1,436.8	33,059	180.5	253.1	.71	.55	.74
March.....	27	1,434.6	36,743	181.0	258.5	.38	.20	.05
April.....	24	1,370.6	32,895	172.3	248.1	4.01	3.93	4.89
May.....	26	1,293.0	33,482	161.6	235.4	14.53	13.74	14.86
June.....	26	1,316.2	34,200	164.4	249.2	6.98	5.92	4.25
Fiscal year 1911..	304	1,314.4	32,635	165.7	241.1	109.53	86.51	97.57
1911.								
July.....	25	1,314.8	32,871	164.3	241.5	7.26	4.00	5.95
August.....	27	1,313.6	35,475	164.0	237.5	7.68	5.98	8.36
September.....	25	1,275.6	31,891	159.4	233.7	5.20	5.46	5.97
October.....	26	1,226.9	31,908	153.4	229.7	12.75	14.97	17.06
November.....	24	1,215.2	29,180	152.0	237.3	10.09	11.73	12.37
December.....	25	1,300.9	32,525	162.6	250.0	.97	.20	.31
1912.								
January.....	26	1,303.8	33,901	163.0	241.0	.06	.01	.00
February.....	24	1,348.9	32,174	168.6	252.1	1.11	.34	.33
March.....	26	1,414.9	36,786	176.9	258.3	.10	.01	.02
April.....	25	1,414.3	31,128	176.9	260.2	.77	2.64	3.14
May.....	26	1,340.0	34,839	167.2	252.7	7.94	6.21	8.15
June.....	25	1,355.8	33,855	169.1	263.8	11.64	8.50	7.57
Fiscal year 1912..	304	1,318.7	33,038	164.8	246.5	65.57	60.05	69.23

The number of cubic yards per shovel per hour under steam averaged as follows:

Fiscal year ended June 30—

1908	-----	121.40
1909	-----	150.46
1910	-----	155.80
1911	-----	165.72
1912	-----	164.78

During the last fiscal year, on account of the practical completion of the north end of the central division, and to the increased depth and lesser width in the Culebra Cut, the steam shovels were necessarily spaced more closely together and the slight decrease in individual efficiency therefore resulted.

In comparing the averages, daily and monthly, shown in the tables above, it should be borne in mind that these averages are based on 8 hours per day, while work in most other places where steam shovels operate is carried on at least 10 hours per day.

The average output per shovel per day within the limits of the central division for each day since the commencement of operations by the United States is shown on plate 83.

PLANT.

The following table shows the motive power, rolling stock, and construction equipment of the central division on June 30, 1912:

Item.	Transferred to division during fiscal year.	Transferred from division during fiscal year.	In service June 30, 1912.
Cars:			
Decauville (industrial).....			72
Dumps, steel—			
Western—			
10-yard.....			224
17-yard.....		20	142
Oliver—			
10-yard.....			216
17-yard.....		205	27
Dumps, steel, Goodwin, 24-yard.....			12
Dumps, wooden, Ingoldsby, 31-yard.....			12
Flat, Lidgerwood.....		13	1,617
Flat, steel.....			43
Motor.....			1
Pay.....			1
Locomotive cranes:			
15-ton.....		1	1
25-ton.....		1	3
100-ton.....			1
Locomotives:			
Decauville 0-4-0 type.....		1	1
Porter, 12 by 18, 0-4-2 type.....			1
Belgian, 15½ by 19½, 0-6-0 type.....			3
Chiriqui, 16½ by 23½, 0-6-0 type.....			10
Baldwin—			
16 by 24, 4-4-0 type.....			2
19 by 24, 2-6-0 type.....		3	20
Cooke, 19 by 24, 2-6-0 type.....		6	78
Brooke, 20 by 26, 2-6-0 type.....		1	19
Pile drivers:			
Moonbeams.....			1
Swing circle.....	1		2
Plows, unloading:			
Right hand.....		1	16
Left hand.....			17
Spreaders:			
Jordan.....			1
Mann-McCann.....			11
Steam shovels:			
45-ton Bucyrus.....			2
70-ton Bucyrus.....		2	7
95-ton Bucyrus.....		1	30
Model 91, Marion.....		1	7
Track shifters.....	1		5
Unloaders, 60-ton Lidgerwood.....		2	22

TRANSPORTATION.

The average number of locomotives working per day and the total locomotive days during the year were as follows:

Class of work.	Average per day.	Total number days.
Handling spreaders.....	5.85	1,779
Handling unloaders.....	10.03	3,048
Handling track shifters.....	2.92	888
Handling dirt and miscellaneous trains.....	117.00	35,558
Average per day and total.....	135.77	41,273

Of the locomotives shown as handling dirt and miscellaneous trains, an average of five locomotives per day were used as pusher engines for getting the loaded trains up the inclines at either end of the Culebra Cut, as, the depth of the canal having increased, these inclines are necessarily longer and somewhat steeper than in previous years. An average of three locomotives per day were used as helper engines in the canal in assisting the road engines in handling trains at steam shovels placed close together in excavating slides and where the grades required the services of more than one locomotive per train. The total number of locomotive days for the above work was 2,432.

The average number of cars loaded daily with excavated material and the total number hauled during the year were as follows:

Class of cars.	Average per day.	Total number handled.
Lidgerwood flats.....	2,402.79	725,642
Large steel dumps.....	320.45	96,775
Small steel dumps.....	973.07	293,869
Average per day and total.....	3,696.31	1,116,286

The largest number of cars handled in one day during the year was on April 2, 1912, when the following number were handled:

Lidgerwood flats.....	2,674
Large steel dumps.....	274
Small steel dumps.....	1,948
Total.....	4,896

The decrease in the number of loaded cars handled daily was due to the transfer of part of the motive power and rolling stock to other divisions, and to the fact that former hauling engines had to be used as helper engines on the Balboa, Miraflores, and Relocation dumps, north of the Chagres River bridge, thereby making it impossible to utilize the relay trains heretofore kept at these points.

At the close of the fiscal year the following trains were in service for the transportation of excavated material: 60 Lidgerwood, 20-21-car trains; 7 large steel dump, 27-car trains; 8 small steel dump, 35-car trains; a total of 75 trains, or a train for each $2\frac{1}{2}$ miles of central division track and less than two trains per shovel.

TRACKS.

The amount of trackage in the central division was decreased by 21.70 miles during the year, making a total trackage in this division on June 30, 1912, of 187.46 miles. To provide running tracks and loading tracks for the steam shovels, approximately 227.13 miles of track were laid, 146.47 miles of track removed, and 1,430.84 miles of track were shifted on the dumps and in the cut by manual labor and track-shifting machines. In addition, 1,096 frogs and switches were laid and 638 frogs and switches removed during the year. Of the above amount of tracks laid and removed it is estimated that from 10 to 15 miles of track, including the necessary frogs and switches, had to be taken up and relaid on account of the action of slides at various points in the canal, the pressure from which caused the bottom of the canal to heave and also caused lateral movement of the bottom, thus throwing the tracks out of alignment.

At least 1 mile of track in the division was buried by slides, so that it was impossible to recover the material in such condition as to be used for relaying.

The location and distribution of the track in the central division is given in the following table:

Name and location.	1909	1910	1911	1912
In canal prism—total, feet.....	364, 163	385, 884	402, 256	385, 100
Caimito.....			3, 840	.....
Tabernilla to Chagrecito.....	27, 835	6, 529		.....
Barbacoas, Caimito Junction.....			10, 870	.....
Powder House line, Santa Cruz.....	10, 526	9, 860	10, 890	10, 600
High line, Obispo diversion.....	25, 860	29, 472	31, 442	23, 700
Santa Cruz, gravel.....			2, 480	1, 100
Bas Obispo.....	6, 833	13, 914		.....
Old Gamboa and Las Cascadas.....	2, 890			.....
Tabernilla yard.....			7, 250	.....
Cucaracha.....	4, 145			.....
Paraiso.....	14, 140	22, 150	19, 565	19, 100
Old Panama R. R., Paraiso to Corozal.....			46, 214	45, 400
Pedro Miguel.....	60, 244	46, 980	52, 537	55, 000
Miraflores third track.....	3, 005	3, 005	3, 005	3, 000
East Mamei.....		2, 750		.....
Gamboa yard.....			11, 700	11, 700
Total east of canal.....	155, 478	134, 660	199, 793	169, 600
Gorgona.....		1, 800		.....
Caimito.....	3, 135			.....
Juan Grande.....		10, 201		.....
Alligator curve.....	9, 011	6, 700		.....
Gorgona yard.....	37, 172	37, 172	9, 700	12, 900
Matachin.....	4, 160	9, 219	8, 800	5, 800
Bas Obispo.....	10, 460	4, 670	2, 230	900
Las Cascadas and Bridge 52.....	13, 310	22, 300	23, 390	23, 400
Whitehouse.....	16, 130	18, 400	19, 511	16, 700
High line, Whitehouse to Lirio.....	7, 075	7, 273		.....
Whitehouse and Empire yard.....			5, 950	7, 700
Cunette.....	3, 220	3, 118		.....
Empire yard.....	46, 213	44, 518	33, 923	41, 000
Lirio.....	26, 694	26, 100	22, 325	20, 400
Culebra.....	8, 415	11, 083	8, 220	4, 500
Rio Grande.....	17, 123	16, 855	17, 425	7, 400
Cucaracha.....	8, 060	5, 850	3, 800	.....
Paraiso.....	5, 346	5, 346	5, 346	5, 300
Total west of canal.....	210, 178	229, 805	160, 530	146, 000
Tabernilla prism dumps.....		3, 225		.....
Tabernilla.....	80, 195	82, 895	55, 400	.....

Name and location.	1909	1910	1911	1912
San Pablo.....	9,475	1,120	1,120	.....
Caimito.....	10,540	985	.....	.....
Mamei.....	3,481	5,300	.....	.....
New Panama R. R., north of Juan Grande.....	2,094	8,028	¹ 29,580	17,800
Gorgona.....	9,500	10,560	9,600	.....
Gorgona River dumps.....	.....	.....	2,700	.....
New Panama R. R., south of Juan Grande.....	16,347	45,866	¹ 88,700	91,000
Point No. 3.....	2,915	13,500	.....	.....
Matchin:	.....	.....	.....	.....
East of canal.....	3,154	.....	.....	.....
West of canal.....	10,259	1,068	.....	.....
Santa Cruz:	.....	.....	.....	.....
East of canal.....	10,978	2,850	.....	.....
West of canal.....	5,224	.....	.....	.....
Lirio.....	10,115	3,725	.....	.....
Gold Hill.....	18,895	11,730	13,450	18,300
Miraflores.....	37,989	39,343	40,860	34,500
Balboa-Panama dumps.....	65,035	76,800	93,230	120,300
Culebra.....	.....	.....	7,174	7,200
Total dump tracks.....	296,196	306,995	341,814	289,100
Total track used by central division exclusive of Panama R. R. main line.....	1,026,017	1,057,344	1,104,393	989,800
Total track in miles.....	194.32	200.25	209.16	187.46

¹ 24,740 feet of this track owned by Panama R. R., but used and maintained by central division.

DUMPS.

The following table shows the disposition of all material excavated from the central division since the inception of work by the United States, including the 17,143.067 cubic yards of material excavated during the fiscal year ended June 30, 1912:

Name of dump.	Wasted prior to July 1, 1912.	Wasted during fiscal year 1911-12.	Total wasted.
Gatun.....	3,789,116	1,585,184	5,374,300
Bohio.....	177,928	.....	177,928
Chagrecito.....	147,718	.....	147,718
Tabernilla.....	16,077,847	10,180	16,099,027
San Pablo.....	1,929,265	281,160	2,210,425
Caimito.....	1,701,414	.....	1,701,414
Mamei.....	967,287	.....	967,287
Juan Grande.....	1,275,642	.....	1,275,642
Gorgona.....	778,612	.....	778,612
Matachin.....	1,823,006	.....	1,823,006
Incline No. 1.....	9,229	.....	9,229
Santa Cruz.....	997,582	.....	997,582
Point No. 3.....	18,177	.....	18,177
Gamboa.....	184,792	.....	184,792
Chagres.....	434,086	.....	434,086
Bas Obispo.....	338,802	.....	338,802
Bas Obispo Dike.....	5,174	.....	5,174
Tunnel diversion.....	61,890	.....	61,890
Obispo diversion.....	1,096,066	56,030	1,152,196
Sardinilla.....	4,054	.....	4,054
Haut Obispo.....	35,525	.....	35,525
Bridge No. 53.....	314,127	.....	314,127
Las Cascadas.....	55,254	.....	55,254
Buena Vista.....	74,045	.....	74,045
White House.....	101,806	.....	101,806
White House yard, Camacho diversion.....	32,756	.....	32,756
Cunette.....	152,215	.....	152,215
Empire.....	82,222	.....	82,222
Cerro.....	176,998	.....	176,998
Cableway.....	1,356	.....	1,356
Culebra.....	1,298,745	.....	1,298,745
Gold Hill and Lirio.....	977,211	882,792	1,860,003
Rio Grande.....	678,854	.....	678,854
Cucaracha.....	48,438	.....	48,438
Cartagenita.....	262,369	.....	262,369

Name of dump.	Wasted prior to July 1, 1912.	Wasted during fiscal year 1911-12.	Total wasted.
Paraiso.....	74,885		74,885
Pedro Miguel.....	543,846		543,846
Miraflores.....	10,441,841	2,872,950	13,314,791
Corozal.....	607,851		607,851
Sosa.....	667,493		667,493
Balboa.....	13,861,817	3,930,543	17,792,360
Bas Obispo crusher.....	184,234		184,234
Naos Island Breakwater.....	390,847	391,084	781,931
Panama R. R. relocation:			
Caimito to Gamboa.....	7,125,682	5,268,890	12,394,572
Paraiso to Corozal.....	953,983	18,800	972,783
East relocation.....	1,783,194		1,783,194
East Manel.....	180,432		180,432
Culebra Swamp.....	243,132	470,158	713,290
Point No. 4.....	611,240		611,240
Pacific division.....	42,600	132,525	175,125
Balboa Y fill.....		350,835	350,835
Ancon Sosa fill.....		671,756	671,756
Colon Breakwater.....		56,384	56,384
Panama R. R. relocation for riprapping.....		90,783	90,783
Miscellaneous.....	3,568,133	72,913	3,641,046
Total.....	77,401,818	17,143,067	94,544,885

All loaded trains from the canal are now hauled out at either end of the Culebra Cut. The only central division dumps now being used for wasting material from the canal proper are those at Miraflores and Balboa for trains run from the south end of the cut, and the relocation dumps for trains run from the north end of the cut over the Chagres River Bridge. The material excavated on the high levels on both sides of the canal is wasted on local dumps with the exception of a few Lidgerwood trains serving the shovels at Rio Grande and Culebra, which are run over the Panama Railroad to the dumps at Miraflores or Balboa.

For finishing the work at San Pablo three old dumps were reopened and two new river dumps started.

The Tabernilla dumps were reopened and used during March, 1912, for wasting a part of the material excavated at that point.

The hauling of material to Gatun for the construction of the Gatun Dam was discontinued on February 15, 1912, on account of the abandonment of the old Panama Railroad double-track line and the transfer of traffic to the single-track relocated line between Gatun and Matachin on that date.

The average amount of material dumped per day at the larger dumps was as follows:

	Cubic yards.
Miraflores.....	9,450
Balboa.....	12,929
Relocation—Gamboa to Caimito.....	17,331

The material deposited at Balboa is serving a useful purpose in reclaiming from the ocean land which in time will be very valuable. The material dumped on the Naos Island Dike serves the twofold purpose of forming a protective dike for the ship channel and providing a means of rail and wagon road connection with the islands in Panama Bay.

During the fiscal year ended June 30, 1912, 69 acres were filled in, making a total of 384 acres in all reclaimed from the ocean at this point.

Between Balboa Y and Ancon and Sosa Hills, 72 acres of marshy land that it was impossible to drain properly were filled in during the year, 1,022,591 cubic yards of material from the canal being used for that purpose. According to present plans, 67 acres more will be filled, making a total area of 139 acres of sanitary filling, which land will doubtless be utilized in connection with the operation of the canal.

It will be noted from the foregoing table that of the total amount excavated during the fiscal year, 15,259,391 cubic yards were wasted on central division dumps, the balance, 1,883,676 cubic yards, having been furnished other divisions and the Panama Railroad, as follows:

	Cubic yards.
Atlantic division, Gatun, for construction toes of Gatun Dam-----	1, 585, 184
Panama Railroad relocation, for fills and riprapping embankment---	109, 583
Pacific division, for back fill of Pedro Miguel locks, etc-----	132, 525
Panama Railroad, for construction of mole, Colon docks-----	56, 384
Total-----	1, 883, 676

The material previously wasted at Miraflores, Balboa, and on the relocation dumps having settled firmly, it was found more economical to start a new layer, or dump, on the top of most of the dumps at these points than to start new dumps. This method, however, slightly decreases the efficiency of the train service, as the grades on these second-layer dumps are so steep that it is necessary for each road engine to assist the unloader engine in pushing its train on the dump after the unloader and plow have been attached, while before the grades on the dumps were too steep for one engine to handle a train, the road engines left their loaded trains in the yards at the dumps and picked up relay empty trains, with which they started back to the canal immediately.

The following table shows the amount of trestle driven in the central division in connection with dumping operations during the fiscal years 1909, 1910, 1911, and 1912:

Name and location.	1909	1910	1911	1912
Balboa (La Boca) dumps.....	6, 539	4, 074	6, 273	1, 360
Culebra dumps.....			920	
Gold Hill dumps.....				1, 450
Cardenas River dumps (Miraflores).....	1, 742			
Haut Obispo to Bas Obispo.....	395			
Bas Obispo.....	1, 256			
Near Bridge 52.....	178			
Canal connection, Matachin.....	780			
Santa Cruz.....	1, 330			
Powder-house line, Santa Cruz.....	1, 361			
Matachin to Santa Cruz.....	136			
Point No. 3.....	439			
Gorgona dump.....	15		448	
Relocation dumps.....		4, 045	4, 749	
Caimito to Tabernilla.....	505	110	868	
Tabernilla dumps.....	897		679	
Trestles in cut.....		169		828
Obispo diversion.....	1, 923	456	462	52
Miscellaneous.....	1, 131		260	
Redriven and repaired.....	882	2, 260		
Total feet.....	19, 509	11, 114	14, 659	3, 690
Total miles.....	3. 09	2. 10	2. 78	0. 69

Grand total, 48,972 feet (8.66 miles).

NOTE.—Of the trestle driven at Balboa dumps during the fiscal year 1912, 1,300 feet was double-track trestle for the Naos Island Dike.

During the fiscal year work was in progress at a number of different places in the central division, and the names of the localities and the amount of work accomplished in each place during the fiscal year, together with the amount yet to be done, are given in what follows:

DIVERSIONS.

A description giving the locations and showing the necessity for the Obispo, Comacho, and Rio Grande diversions were given in the annual report for the fiscal year ended June 30, 1910.

In March, 1912, cracks appeared on the east side of the Obispo diversion, south of the Empire Suspension Bridge, about station 1725, indicating that between 400,000 and 500,000 cubic yards of material were in motion. If a slide had developed of the magnitude indicated by the cracks, it would have broken back into the diversion for a distance of about 600 feet. Steps were therefore immediately taken to relocate the diversion farther to the eastward. Plans were approved and construction work was commenced early in April and finished during that month, every effort being made to finish the work before the rainy season commenced, and to do this three shovels were kept at work all the time. In all, 26,168 cubic yards were excavated for the detour diversion, which is 1,970 feet long and located 510 feet east of the old diversion at its most distant point. The Empire-Paraiso wagon road and the railroad were relocated on the west bank of the new diversion.

During the latter part of the last fiscal year the slide between stations 1618 and 1637, on the east side of the canal, opposite White House, threatened to break back into the Obispo diversion at that point. The movement of the material in the slide is slow, but it was deemed safer to relocate the diversion as far to the eastward as possible—about 100 feet from the present location—than to attempt to retain the present channel. This plan will require the construction of about 500 feet of trestle and the excavation of about 15,000 cubic yards of earth, which work will be started during the first month of the new fiscal year.

Just after the hardest rainfall of the last fiscal year, which occurred on November 13, 1911, and amounted to 2.78 inches, the maximum discharge through the Obispo diversion flume, described in annual report for fiscal year ended June 30, 1911, was 1,805.3 cubic feet per second, and at the tunnel in the Camacho diversion 1,650 cubic feet per second.

CULEBRA SECTION.

This section extends from Gamboa to Pedro Miguel and is usually known as the Culebra Cut. Dry excavation having been completed in the Chagres section, all efforts are now concentrated on the Culebra section only.

Previous to June 30, 1911, 64,243,130 cubic yards had been excavated in the Culebra section. During the fiscal year ended June 30, 1912, 16,476,769 cubic yards were excavated, leaving 11,863,540 cubic yards to be excavated in order to complete this section and the entire central division, with the exception of about 151,000 cubic yards of wet excavation still remaining in the Chagres section.

POINT 1.

In all, 91,300 cubic yards were excavated at this point during the past fiscal year, of which 27,632 cubic yards were from the canal prism and the balance, 63,668 cubic yards, outside of prism. All the above excavation was gravel deposited by the Chagres River, which was removed and stored for use as ballast and in concrete work. At the close of the fiscal year the central division had 110,000 cubic yards of gravel in storage piles. On June 30, 1912, 90,000 cubic yards of silt remained, which will be removed by suction dredges when Lake Gatun has reached the proper elevation.

POINT 2.

No excavation was accomplished at this point during the fiscal year. The amount remaining June 30, 1912, was 7,300 cubic yards of silt.

POINT 3.

No excavation was accomplished at this point during the fiscal year. The amount remaining June 30, 1912, was 50,000 cubic yards.

POINT 4.

No excavation was accomplished at this point during the fiscal year. The amount remaining June 30, 1912, was 1,000 cubic yards.

POINT 4-B.

During the fiscal year 56,380 cubic yards were removed from this point, 44,184 cubic yards by contract and the balance, 12,196 cubic yards, by the central division forces. The amount remaining June 30, 1912, was 2,700 cubic yards.

SAN PABLO.

The excavation of the embankment on which the old line of the Panama Railroad crossed the canal was commenced in January, 1912, and completed in May, 1912. In all, 305,291 cubic yards were removed, which finished all work at this point.

TABERNILLA.

Excavation was commenced in March, 1912, and finished during the same month, 22,893 cubic yards being removed, completing the work at this point.

BUENA VISTA.

Excavation was commenced in March, 1912, and finished during the same month, 100 cubic yards being removed, completing the work at this point.

BOHIO.

Steam-shovel excavation was commenced by the central division in February, 1912, and finished in March, 1912, 6,997 cubic yards being removed. A total of 101,600 cubic yards were removed by contractor during the fiscal year, which completed all work at this point.

PENA BLANCA.

Forty-eight cubic yards were removed by hand at this point during March, 1912, completing all excavation here.

GATUN.

The excavation of the Panama Railroad embankment across the anchorage basin at this point was commenced in March, 1912, and finished in April, 1912, 39,568 cubic yards being removed, completing all work at this point.

HAND WORK BY CONTRACT.

A contract was entered into with Earl C. McFarland on March 21, 1910, for the excavation of about 202,140 cubic yards in the canal prism between Tabernilla and Bohio, at a cost of 21 cents per cubic yard for earth, 25 cents per cubic yard for soft rock, and 30 cents per cubic yard for hard rock. On May 26, 1911, a supplementary agreement was entered into with Earl C. McFarland, establishing a price of 34 cents per cubic yard for all earth, soft and hard rock remaining to be excavated after April 25, 1911.

Work was begun by the contractor in October, 1910, and completed in April, 1912. In all 207,132 cubic yards were excavated under this contract, at an average cost of 30.6 cents per cubic yard.

Another contract was entered into with Llewelyn Swain, December 6, 1910, to excavate about 112,450 cubic yards in the canal prism between stations 28 plus 1,000 and 28 plus 2,300, at a point commonly known as Point 4-B, at a cost of 21.5 cents per cubic yard. Later a supplementary agreement was entered into with Llewelyn Swain, establishing a price of 31½ cents per cubic yard for all material removed subsequent to March 22, 1912.

Work was begun by the contractor in December, 1910. Up to May 16, 1912, but 108,992 cubic yards had been excavated when the contractor signified his inability to continue the work. The central division was therefore directed by the chairman and chief engineer to take over this work and complete same, any excess cost over and above 31½ cents per cubic yard to be paid to the central division from the bonds furnished by the contractor at the time of signing of the contract. The contractor removed 103,896 cubic yards, at 21½ cents per cubic yard; 5,096 cubic yards, at 31.5 cents per cubic yard; and the central division 12,196 cubic yard, leaving 700 cubic yards to be removed by dredging during the next fiscal year.

CLEARING CHANNEL IN LAKE GATUN.

A small force was engaged during a part of the year in blasting stumps and trees in the channel in Lake Gatun. In addition to this work some overhanging trees and limbs were removed for the central division by the first division.

WORK IN CONNECTION WITH LIGHTING AND BUOYING.

On September 1, 1911, this work was turned over to the first division, and a transfer of allotment was made accordingly.

From July 1 to August 31, 1911, 33,347 feet of profile were run and 95,760 feet of trocha cut. The cost of this work was 9.78 cents per foot of profile run. In connection with this work it was necessary to clear 279.2 acres, at a cost of \$18.72 per acre.

From May 1, 1911, when work was started, to August 31, 1911, the total work completed by the central division was as follows: Profile run, 49,547 feet (9.9 cents per foot of profile run) ; Trocha cut, 163,310 feet; clearing, 652.7 acres, at \$24.23 per acre.

NAOS ISLAND DIKE.

This dike is to extend from the shore at East Balboa to Naos Island, a distance of 3.29 miles from the mainland, and is being constructed for the purpose of shutting off the swift current which at flood tide flows across the canal channel in Panama Bay, nearly at right angles, and not only causes heavy deposits of silt, but also tends to carry vessels out of the channel to the westward.

To construct this dike a pile trestle over 3 miles in length is being driven from the shore toward the Island. From this trestle material from the Culebra Cut is dumped and when the trestle is filled the tracks are shifted laterally and the dike widened and used as a dump. Prior to June 30, 1911, the trestle had been constructed for a total distance from the shore line of 2.78 miles. During the fiscal year this trestle was extended 1,360 feet, giving a total length of trestle constructed up to June 30, 1912, of 16,051 feet or 3.04 miles. The end of the trestle on June 30, 1912, was 1,320 feet from Naos Island, and the fill was extended to within 2,000 feet of the end of the trestle.

The trestle is driven for the greater part of its length in blue mud varying from a few feet to 102 feet in depth. The particles of which this mud is composed are exceedingly fine, and the mud itself is almost wholly free from sand and feels greasy and very slippery to the touch and its coefficient of friction is unusually small.

Much trouble has been experienced for the past two years in extending the dike, owing to the sliding of the bottom under pressure, due to the weight of the stone filling dumped from the trestle. This sliding has been encountered on every foot of the last two-year's work and results in continual settlement of the stone filling for two or three months, when it gradually diminishes and finally ceases.

The total vertical settlement at one locality on the dike during the fiscal year aggregated 125 feet. Not 1 foot of trestle constructed during the past two years remains at present under the track for which it was intended, parts of the trestle sliding to one side and parts to the other, in some cases moving laterally as much as 300 feet.

The settlement, as would be expected, almost invariably takes place at or just before low water, and is usually greatest at times of extreme low water of spring tides, owing to the fact that at such times the total pressure on the base of the mound of riprap filling is much greater than at high tide, the extreme range at this locality being about 20 feet. Consequently, at extreme high water only about 4 feet of the dike, and that the narrowest portion, is above water, whereas

at extreme low water, 24 feet of the total height of the dike lie above the water level.

As the material of which the dike is composed loses two-fifths of its weight when submerged, it will readily be seen that even though the dike be kept at a constant height there is a great variation of pressure on the bottom throughout the day, and that ordinarily this pressure rises from its minimum to its maximum value in less than seven hours and decreases in the same period. Experience in other localities where the water level remains nearly constant shows very clearly that the sliding of the bottom is greatly increased by the very large fluctuations of the water level.

The elevation of the top of the trestle is 14 feet above mean tide, and the average depth of the water for the last mile of trestle constructed is about 15 feet at mean tide, giving a total height of trestle of about 29 feet above the original bottom.

When the rock filling is dumped from the trestle it begins to settle as soon as it attains a height of a few feet, pushing up from the bottom a parallel ridge of mud on each side of the trestle. By the time the rock fill has been completed to full height, the center of each of these parallel ridges of mud is about 80 feet from the center of the track. Each of these ridges is separated from the ridge of stone filling, which caused their upthrust, by a hollow or channel of 10 to 15 feet in width, the bottom of which has remained practically undisturbed, showing that the settlement of the stone filling and the upthrust of the mud bottom take place on opposite sides of a nodal line and involve considerable underground lateral motion.

To give some idea of the extent of the settlement of the stone and of the large quantity of mud thrust up from the bottom, it may be interesting to state that on one section of this work an accurate record was kept of the quantity of stone necessary to bring the fill up to full height, i. e., 29 feet above the original bottom, and it was found that the actual quantity of stone required was almost exactly ten times the theoretical quantity which would have been required had the bottom been solid and unyielding.

Photographs taken in December, 1911, showing the end of the trestle and the upthrust of the bottom on the east and west sides of the trestle, respectively, accompany this report. (Plates 44 and 45.)

Although this has proven to be one of the most difficult pieces of construction work yet encountered in the central division, and although the quantity of stone filling required has been so greatly in excess of the original estimate, yet owing to the fact that there has been practically an unlimited amount of material from Culebra Cut available for this work, the cost as a whole is moderate when compared with other ocean works of a similar character built on much better bottom.

The total cost of the dike up to June 30, 1912, has been \$186,396.79, or about \$13 per lineal foot. Of this amount \$70,558.01 has been charged to the Pacific division. The figures just given represent the cost of the trestle and all additional costs over and above what it would have cost to waste material on the ordinary dumps.

SLIDES AND BREAKS.

The progress of excavation in the Culebra Cut has been retarded and rendered more difficult on account of slides and breaks in the

banks of the canal. This trouble, as was to be anticipated, rapidly increased as the cut was deepened, and the amount of material removed on account of breaks and slides during the past fiscal year, 5,915,000 cubic yards, is the greatest during any year since the commencement of operations. A table showing the total excavation, the amount removed from slides and breaks, and the percentage involved in slides follows:

Year.	Total excavation.	Removed from slides.	Amount removed from slides.
	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Per cent of total.</i>
1904-1909.....	40,983,366	3,227,059	7.87
1910.....	17,865,808	2,649,563	14.83
1911.....	18,552,644	4,879,378	26.30
1912.....	17,143,067	5,915,000	34.50
Total.....	94,544,885	16,671,000	17.63

No plan of treatment for slides has proven thoroughly effective when once they have developed, except that of excavating and hauling away the material composing the moving mass until the slide comes to rest upon reaching the angle of repose for the particular material then in motion. This angle of repose varies greatly in different parts of the cut, depending not only upon the character of the material involved in the slides, but also upon the angle of inclination of the strata and the angles at which the numerous dikes cross the canal.

At the Cucaracha slide, which has been practically at rest now for over a year, the angle of repose corresponds to a slope a trifle steeper than one vertical to five horizontal, while on the west bank of the cut at the town of Culebra, near the center of the Culebra slide, the material (argillaceous sandstone) is still moving slightly, although the slope of the bank at present is but little steeper than one vertical to five horizontal.

In one or two slides the surface on which the sliding material was moving had a slope of one vertical to ten horizontal, and in the case of another slide on the west bank of the canal, just above the village of Culebra, the moving material consisted of stratified rock (see photograph, plate 42), which was moving en masse on a layer of lignite about six inches in thickness, which had an inclination of about one vertical to seven horizontal, and was underlaid by other layers of sedimentary rock which did not move.

This last slide developed early in the dry season and moved at a faster rate for the succeeding four dry months than it has done since the rains have come. These very flat slopes of the banks in the deepest portion of the cut explain the large amount of material added by slides and breaks; the estimate made by the International Board of Consulting Engineers having been based upon side slopes of three vertical on two horizontal for the greater part of this section of the cut. Slides caused by a top covering of clay sliding on an inclined surface of harder material, as would be anticipated, are most troublesome during the wet season, but the breaks which during the past fiscal year have involved more yardage than the slides proper cause as much trouble in the dry season as in the wet season, and during the last prolonged dry season of five months the proportion of breaks which developed were in excess of those developing during any similar period of the wet season.

A number of the slides and breaks have been described in former annual reports, one of the most noteworthy of these being the Cucaracha slide, which developed in July, 1905, and from which nearly 3,000,000 cubic yards have been excavated to date, only 170,000 cubic yards of which were excavated during the fiscal year. This slide covers an area of 47.1 acres, and at present gives no evidence of any considerable future movement.

By far the most extensive slide, or, more strictly, "break," is that on the west bank of the canal at Culebra, extending practically continuously from station 1726 to station 1804, and covering an area of 63 acres. From this area 6,765,500 cubic yards of material had been removed up to June 30, 1912, and it is estimated that 1,300,000 cubic yards yet remain to be excavated. Of the total quantity of material removed from this slide 2,710,000 cubic yards were removed during the fiscal year just ended. This slide first developed in October, 1907.

The next largest slide lies directly across the cut from the one last described and extends practically continuously from station 1741 to station 1796, covering an area of 50.7 acres. From this slide 4,290,000 cubic yards have been removed and 600,000 cubic yards yet remain to be removed. Of the total amount of material removed from this slide, 1,960,000 cubic yards were removed during the fiscal year just ended. This slide first developed in January, 1907.

The three slides just mentioned are the only ones which have so far developed in which the total quantity of material involved exceeds 1,000,000 cubic yards, although, as will be seen from the table which follows, 16,671,000 cubic yards of material have been removed on account of slides and breaks up to date, and 3,595,000 cubic yards are estimated as remaining yet to be excavated, or a total of 20,266,000 cubic yards of additional material to be excavated on account of slides and breaks in order to complete the canal. Details regarding all of the principal slides in the central division, all of which are confined to the Culebra section of this division, are given in the following table:

Estimate of slides outside of slope lines for year ending July 1, 1912, showing total estimates of material to date.

Location.	Date when slide first developed.	Cubic yards excavated year ended July 1, 1912.	Cubic yards of material excavated to date.	Cubic yards of material remaining.	Area of slide in acres.
East side:					
Opposite Bas Obispo.....	Sept., 1910	6,000	117,000	70,000	2.80
Opposite Haut Obispo.....	Sept., 1908	.....	18,000	.....	.60
West side, opposite Buena Vista.....	Nov., 1908	119,000	162,000	.....	3.30
East side:					
Opposite Las Cascadas.....	Feb., 1908	2,000	503,000	.....	11.50
Do.....	Sept., 1909	80,000	102,000	20,000	1.40
Opposite White House.....	Oct., 1908	.....	286,000	.....	4.60
West side, White House yard.....	June, 1912	.....	.....	130,000	1.00
East side:					
Opposite White House.....	Oct., 1909	195,000	413,000	180,000	5.80
Upper La Pita.....	Dec., 1909	.....	20,000	.....	1.70
Lower La Pita.....	May, 1910	.....	30,000	50,000	.30
West side:					
Cunette.....	Sept., 1910	4,000	67,000	10,000	.90
Empire.....	May, 1910	165,000	210,000	50,000	2.20
Culebra.....	Oct., 1907	2,710,000	6,765,000	1,300,000	63.00
East side:					
Culebra.....	Jan., 1907	1,960,000	4,290,000	600,000	50.70
Cucaracha.....	July, 1905	170,000	2,890,000	230,000	47.10
West side, Contractors Hill.....	July, 1908	5,000	216,000	15,000	2.00
East side:					
Cucaracha village.....	Sept., 1911	57,000	57,000	160,000	3.40
Paraiso.....	Mar., 1907	62,000	385,000	10,000	5.70
Small slides.....		.....	140,000	770,000	.....
Total.....		5,535,000	16,671,000	3,595,000	208.00

To the total of the first column of figures of the preceding table should be added 380,000 cubic yards to cover material from very small slides not embraced in the table.

The work of decreasing the pressure on the banks where slides might be expected, by excavation with steam shovels, has continued uninterruptedly since its commencement in January, 1911, three shovels having been kept continuously at work terracing the west bank in the vicinity of the Culebra slide and the same number of shovels, during the greater part of the fiscal year, on similar work on the opposite bank. In addition, one shovel is engaged in the same work on the west bank at White House yard and another shovel on the east bank just south of the Empire Suspension Bridge. The maximum depth of material removed at one spot was 80 feet (measured vertically) on the west bank, in a succession of nine terraces, and about 70 feet on the east bank, also in nine terraces.

As a whole, the removal of weight from the edge of the banks has been beneficial, as less trouble has been experienced during the past fiscal year by the crushing of underlying layers of softer material and the heaving up of the bottom, due to excessive earth pressure from above, than was experienced before the commencement of this work. Yet the moving of the banks and the heaving has not been entirely stopped by this work, for breaks have occurred within the past month or two, both on the eastern and western banks, near Culebra, at points where the lightening of the load, as above described, had been greatest.

The results obtained, however, on the whole are considered sufficiently favorable to warrant the continuance of this work until all excavation in the cut has been completed and the full depth and width have been obtained.

Most of the so-called "slides" during the past year were in reality "breaks" in the bank, resulting from the failure of an underlying layer of rock of poor quality, due to the pressure of the enormous weight of the superincumbent mass, which crushes the underlying layer, forces it laterally, and causes it to rise up or heave in the bottom of the cut, this heaving at times extending to a height of as much as 30 feet. During the past fiscal year, however, in no case has the bottom of the cut heaved up to a height greater than 15 or 20 feet.

As a result of several years' experience, the removal of slides and breaks is now carried out with much less inconvenience and interruption to work than was the case in the earlier stages of operations. The principal annoyance now caused by slides is the carrying away of the tracks in the cut, either by lateral displacement or more often by subsidence of an upper level and upheaval of the bottom. In a few cases where the bank subsides by the crushing of the underlying material, forcing this material laterally and upward, a track located just between the mass which is subsiding and that which is being upheaved is so little disturbed, occupying as it does a nodal line with respect to the movement, that trains can use it in safety, although the tracks on one side may have settled several feet and those on the other side may have risen as much.

There appears to be a very general misconception on the part of the public as to the nature of the material which is heaved upward

from the bottom of the cut, many supposing that the upheaved material is like clay or stiff mud, and it might be well to mention that in the case of the greatest upheaval during the past fiscal year, on the west bank of the cut opposite Culebra, where the bottom of the cut was upheaved to a maximum height of about 20 feet, an attempt was made to estimate the sizes of the pieces of argillaceous sandstone which composed the material upheaved. These pieces varied in volume from a few cubic inches to 20 or 30 cubic yards and would probably have averaged from 1 to 3 cubic yards in volume.

COST OF EXCAVATION.

The average cost of the various items of expense in connection with excavation is shown in the following table, giving comparison with the fiscal years 1908, 1909, 1910, and 1911:

Class of work.	1908	1909	1910	1911	1912
Loading, steam shovels.....	\$0.1150	\$0.1001	\$0.0888	\$0.0717	\$0.0681
Loading, hand ¹		.3993	.3442	.2567	.3056
Drilling and blasting.....	.1413	.1149	.1190	.1048	.1157
Transportation.....	.1854	.1452	.1522	.1414	.1331
Dumps.....	.1344	.0911	.0657	.0541	.0479
Tracks.....	.1190	.0838	.1001	.1014	.0885
Division office and supervision.....	.0163	.0114	.0150	.0120	.0142
General surveys.....	.0008	.0001	.0003	.0002	.....
Clearing site.....	.0004	.0048	.0046	.00005	.0001
Division structures.....	.0002	.0012	.0013	.0005	.0003
Drainage and sumps.....			.0052	.0038	.0041
Total division cost.....	.7128	.5517	.5416	.4880	.4707
General expense and administration expense ²	.1882	.1049	.0646	.0457	.0361
Plant arbitrary ³	.1300	.1300	.1300	.1000	.0395
Total.....	1.0310	.7866	.7362	.6337	.5463

¹ Contract work.

² This expense is not under the control of the central division, being proportion of expense of chairman's, chief quartermaster's, disbursing officer's, examiner of accounts' offices, etc.

³ This arbitrary is intended to absorb the entire cost of all plant by the time that work is completed.

NOTE.—In determining costs the following yardage was used:

	Cubic yards.
From canal prism.....	17,009,646
From Obispo diversion.....	26,168
Silt deposit in prism.....	27,632
Total.....	17,063,446

The cost of drilling and blasting, as shown on the table, has been distributed to cover the total number of cubic yards of excavation, but to get the real cost it should be applied to material actually mined, which amounts to 12,862,968 cubic yards, which would make the cost when thus applied \$0.1523 per cubic yard.

It will be noted from the preceding table that the division cost per cubic yard for the fiscal year ending June 30, 1912, is the lowest since the commencement of operations by the United States, and it appears reasonably certain that the figures given will mark the lowest annual unit cost in the central division during the entire progress of excavation, for the decreasing output as the work approaches completion and the removal of nearly 200 miles of track and many miles of pipe must inevitably result in increase of unit cost.

It will further be noticed that "loading, steam shovels," "transportation," and "dumps" were all cheaper than ever before in the

history of the work. This result was attained by constant study by the division engineer and his assistants of cost and output sheets, and by the constant and cordial cooperation and assistance of the various division officials.

Natural conditions become more unfavorable for cheaper work from year to year as the cut becomes deeper and its width becomes less. This increased depth has necessitated longer and steeper inclines and has required the services during the past fiscal year of an average of eight helper engines on duty per day, at a cost of about \$12,800 per month, or \$153,600 for the fiscal year.

Operations have been inconvenienced very materially during the past year by the large amount of material which has been removed from the slides and by the destruction of tracks, due either to their being covered by slides or being heaved up and displaced.

The percentage of rock excavated during the past year, 83.67 per cent, is considerably higher than in any preceding year, entailing additional cost for drilling and blasting.

The output has been somewhat decreased and the cost correspondingly increased, owing to the fact that a considerable portion of the cut was practically completed during the fiscal year, necessitating a large number of narrow and shallow steam-shovel cuts in order to remove all material to final grade and slope, and requiring a number of drill holes next the banks in order to blast the material more accurately to slope.

On the other hand, the influences which would naturally have favored the reduction of cost were the small amount of rainfall during the fiscal year and the increased efficiency which would be expected of the organization, due to longer experience.

The official records show that from the commencement of work by the United States to September 1, 1908, there had been excavated within the limits of the central division 24,923,281 cubic yards of rock and earth, the average "division cost" of which had been \$0.9344 per cubic yard. It was believed that this cost could be very materially reduced, and the division engineer, in forwarding his estimate of the unit cost of all dry excavation in the central division, subsequent to September 1, 1908, for incorporation in the estimate to be submitted by the chairman and chief engineer, gave 75 cents per cubic yard as the estimated "division cost" of all dry excavation remaining to be done after September 1, 1908, a figure which was only 80 per cent as much as the average unit cost of all dry excavation up to that time.

It is gratifying to state that from September 1, 1908, to June 30, 1912, inclusive, there have been excavated within the limits of the central division 69,478,400 cubic yards of rock and earth (about three-fourths being rock), at an average division cost per cubic yard of \$0.5127.

The difference between the unit price of the above material as estimated September 1, 1908, and of the actual unit price at which the work was done amounts to a total of \$16,485,725. This total amount, however, will not be a clear saving when all work has been completed, as a considerable amount of additional work, not then contemplated, has been done since the estimate of September 1, 1908, was submitted, and more especially because fully 16,400,000 cubic yards, in addition to the estimate of September 1, 1908, will have been added by slides

before the canal has been completed. Yet in spite of these large additions, aggregating about 18,000,000 cubic yards, to the quantity of material embraced in the original estimate, it now seems probable that there will be a net saving in the central division, on the original estimate of cost of September 1, 1908, of several million dollars when the canal has been completed.

COAL AND FUEL OIL CONSUMED.

The total quantity of coal used during the fiscal year amounted to 104,658 long tons. Coal is the only fuel used except at the following pumping stations, at which points 11,767.59 barrels of fuel oil were used during the fiscal year: Cucaracha, Camacho, Gorgona, and Tabernilla.

STEAM SHOVEL REPAIRS.

Since November 5, 1907, the central division has had a force of boiler makers, pipe fitters, and machinists, with the necessary helpers, working in the cut at night repairing steam shovels, and it has been found by experience that greater efficiency can be obtained in steam-shovel work if all repairs possible are made in the field without sending the steam shovel to the shop for general overhauling. Since the organization of this steam shovel night gang, circles and booms, dippers and dipper sticks, A-frames, hoisting drums, main engine shafts, propelling shafts, swinging drums, intermediate shafts, water tanks, feed pumps, trucks, and, in one or two cases, steam-shovel boilers have been changed in the cut. In fact it is the practice to replace everything except the base castings, the deck of the shovel, and the boilers in the field. In addition a machinist and necessary helpers have been assigned to each district for service during the day, their duties being to inspect each shovel in the district daily and make all minor repairs that do not require the use of a crane. A considerable saving of time in making repairs is made by this arrangement, as these men are available more promptly than when men had to be sent from Empire shops.

In the interest of economy, and by direction of the chairman and chief engineer, the repairing of steam shovels and the manufacture and repair of steam shovel parts for the entire canal were transferred to the central division, effective October 1, 1909. In order to handle this work the Empire shops were transferred from the mechanical division to the central division, and all other mechanical work, formerly handled at the Empire shops, was transferred to the Gorgona shops. Prior to this date the mechanical division handled all shop repairs to steam shovels and the other two construction divisions handled their own repair parts and field repairs independently. The other divisions still handle their own field repairs.

The average pay roll during the year was \$26,384.28 per month, of which 23 per cent, approximately, was for the central division field repairs, 45 per cent for shop repairs for the central division, and 32 per cent for shop repairs for other divisions and for manufacturing for all divisions.

The total number of steam shovels repaired in the Empire shops for the period above mentioned was 20 and the average time each was in the shop was 31 days. The average number of shovels repaired

in the cut each night was 14, and the average number of men employed in the night repair gang in the cut was 13 gold and 39 silver men.

By direction of the chairman and chief engineer, the Empire shops, with the entire personnel, as well as the night steam-shovel repair outfit and the men employed on steam-shovel repair work in the cut during the day, were transferred to the mechanical division on July 1, 1912; as the reduction in excavation and the concentration of steam shovels and the stage of the completion of the work did not justify maintaining separate shops at Gorgona and Empire, and as no feasible way could be found of maintaining both shops and making a reduction in cost to correspond to the reduction in construction work.

AIR AND WATER SERVICE.

During the fiscal year, in furnishing air connections for drills and other purposes, 3,284,980 feet of pipe were laid, while 3,262,600 feet of pipe were removed. The central division maintained the air mains leading from the air compressors and paralleling the canal on the east and west banks.

In furnishing water connections for steam shovels, orange peel and clam shell cranes, locomotives, and for other purposes, 2,531,550 feet of pipe were laid, while 2,516,040 feet of pipe were removed.

MUNICIPAL WORK.

During the fiscal year ended June 30, 1912, municipal work was carried on as in the past, the principal items of work performed being as follows:

Water:		
Pipe laid	feet	27,702
Pipe removed	do	67,287
Pipe relaid	do	25,330
House connections made		54
Meters installed		90
Hydrants installed		2
Oil pipe installed	feet	650
Oil pipe removed	do	4,180
Sewer:		
Pipe laid	do	4,892
House connections made		32
Sanitary work:		
Regrading ditches	linear feet	311,061
Ditches dug	feet	5,763
Ditches cleaned	do	1,613,820
Tile drains laid	do	550
Concrete gutters made	do	11,650
Concrete ditches cleaned	do	341,214
Clearing	square yards	6,536
Miscellaneous: Concrete pipe made	linear feet	1,230

ROAD BUILDING.

The construction of what is known as the Empire-Chorrera Road was commenced in April, 1911, and was continued throughout the fiscal year. On June 30, 1912, macadam had been laid and rolled on 11,230 linear feet. In addition to this, subgrading, including neces-

sary concrete culverts and drains, was completed for a distance of 12,450 linear feet. After preparing the subgrade, which was rolled, Telford foundation was laid on the road to an average depth of 10 inches for a distance of 12,450 feet. This is a 16-foot macadam road, and will extend from the village of Empire to the Zone boundary line, a distance of about 6 miles, and will be extended to Chorrera by the Panama Government.

In connection with the construction of this road, it was necessary to erect a stockade for the housing of the convicts used on its construction; this stockade was erected about 4 miles from the village of Empire, near what is known as Mandingo River. The building constructed was 150 feet by 50 feet, the main part being divided into two cells, with the necessary quarters for the officers and a dining hall attached. The structure was inclosed by a yard 300 feet by 100 feet, fenced in by a double row of barb-wire fence. The building was erected from the hardwood material secured in the surrounding country, and covered with galvanized iron.

Approximately 60 miles of trails were cleaned and drained during the year. The labor for this purpose was furnished by natives working out their poll tax. All necessary bridges were constructed of native hardwood.

The Empire-Paraiso Road was relocated for a distance of 2,480 feet and constructed. This was necessary on account of a slide along the east bank of the canal.

In the village of Culebra, 1,400 linear feet of road were reconstructed on account of slides on the west bank of the canal.

In the village of Golden Green 1,650 feet of road were constructed.

The following work was accomplished in connection with the maintenance of roads, the maintenance of cinder paths having been transferred to the Quartermaster's Department:

General repairs	square yards	86,552
Ditches cleaned	do	512,744
Ditches excavated	linear feet	2,395

The above includes the resurfacing and rolling of the Empire-Paraiso Road and the resurfacing, reditching, and rerolling of the Las Cascadas Plantation Road.

WATERWORKS.

The use of Rio Grande, Camacho, and Carabali reservoirs, which supply the various settlements with water, was continued throughout the year, and the pumping stations at Paraiso, Cucaracha, Lirio, Camacho, Gamboa, Point 4, and Gorgona were operated during the year. The pumps at Tabernilla and Bohio were operated until the abandonment of the camps at those places, Tabernilla station being closed on March 17, 1912, and Bohio station on November 27, 1911. The pumping station at Bas Obispo was not operated at all during the year, and was dismantled in February, 1912. The condenser plants at Las Cascadas and Bas Obispo were operated during the year, condensing daily an average of 3,000 gallons of water.

After the closing of the Tabernilla pumping station a temporary pump was installed at the north end of the Barbacoas Bridge for supplying water for construction purposes. This temporary plant

was closed on May 5, 1912, and the condenser plant at San Pablo was closed on the same date.

In December, 1911, it was realized that it would be necessary to install auxiliary pumps on the Chagres River to assist the reservoirs in furnishing a sufficient amount of water for general use in the central division until such time as the rainy season replenished the supply. A purchase was therefore made of two 3-stage centrifugal pumps, belt driven, with a rated capacity of 2,000,000 gallons under a working pressure of 150 pounds. These were installed under the Chagres River Bridge and put in service on the 24th of January, 1912, acting as feeders for the mains on the east and west banks of the canal.

During the latter part of February, it was found necessary, due to the rapid failure of the Carabali reservoir supply, to operate the Chagres pumping station for the supplying of water to the Gorgona shops for mechanical purposes, the consumption of water at the shops averaging 400,000 gallons per day. In addition to this, a 6-inch line was laid connecting the Gorgona and Gamboa systems. The length of this line was 3,200 feet, and it supplied water to the Panama Railroad tank at Matachin, the town of Matachin, Jamaicatown, and the engine house at Gorgona shops; the consumption amounting to approximately 200,000 gallons per day. This work was completed on March 12.

As a precautionary measure a booster pump was also installed in this line near the Gorgona shops for supplying the town of Gorgona. The installation was completed on the 14th of April, and it was necessary on April 16, due to the absolute failure of the Carabali reservoir supply, to put this plant in operation, supplying water to the town for domestic purposes until the 16th of May, when a sufficient amount of water had again accumulated in the reservoir for supplying the town, the consumption being approximately 250,000 gallons per day.

On April 18 the installation of an additional piston pump on the Sardanilla River was completed which increased the supply for canal purposes at this point to 400,000 gallons per day.

On June 8 a piston pump of a capacity of 1,500 gallons per minute, under a working pressure of 250 pounds, was procured from the Atlantic division. Before putting this pump in operation it was necessary to replace 4,100 feet of 6-inch cast-iron pipe with 6-inch wrought iron pipe in order to withstand the pressure. The installation was completed and the pump tested out on June 13, the date on which the supply in the Camacho reservoir was exhausted, leaving the supply of water for the central division entirely dependent on the different pumps installed.

In addition to the pumps mentioned, an underwriters fire pump, with a rated capacity of 1,500 gallons per minute, has been procured from the subsistence department and installed as an auxiliary on the Chagres River.

Approximately 547,500,000 gallons of water were consumed by the central division from the Rio Grande reservoir, which is operated by the Pacific division. The daily average consumption from the Camacho was 1,600,000 gallons, and from Carabali 850,000 gallons. The average daily consumption from the Chagres River since Febru-

ary 23, 1912, through the Gamboa pumping station was 3,000,000 gallons.

The total pumps in service numbered 29. The daily average number of pumps working at the various stations was 21. The daily average number of gallons pumped at the different pumping stations was 3,216,475; total for the year 1,177,229,886 gallons. The daily average number of gallons condensed at the various stations was 10,677, and the total for the year, 3,907,782 gallons.

During the fiscal year the summit of drainage in the cut was at a point in the canal opposite Culebra. All water south of this point is drained into the Pacific Ocean by gravity through a culvert in the Pedro Miguel Locks. The sump pumps which were installed at the south end of the cut were removed upon the completion of the drainage cut to the north end of the Pedro Miguel Locks. All water entering the cut north of this drainage summit is pumped into the Chagres River by the sump pumps at the Bas Obispo Diike. At the close of the fiscal year the following pumps were in service for this purpose:

Three duplex pumps, 16 by 22 by 18 inches; capacity, 4,200 gallons per minute each.

Two Wagner pumps, 16 by 8 by 12 inches; capacity, 445 gallons per minute.

One Worthington centrifugal pump, 24-inch discharge; capacity, 18,000 gallons per minute.

Two French centrifugal pumps, 17-inch discharge; capacity, 7,000 gallons per minute each.

The piston pumps are arranged to operate by air or steam so that they can work under water if necessary.

LABOR SITUATION.

During the fiscal year the labor situation was entirely satisfactory, the supply of laborers being greater than the demand during the entire year on account of the reduction of force which has been gradually made in this and other divisions. The majority of the laborers in the central division are West Indian negroes. The average daily number of laborers in the central division for the fiscal year just ended was 7,335.

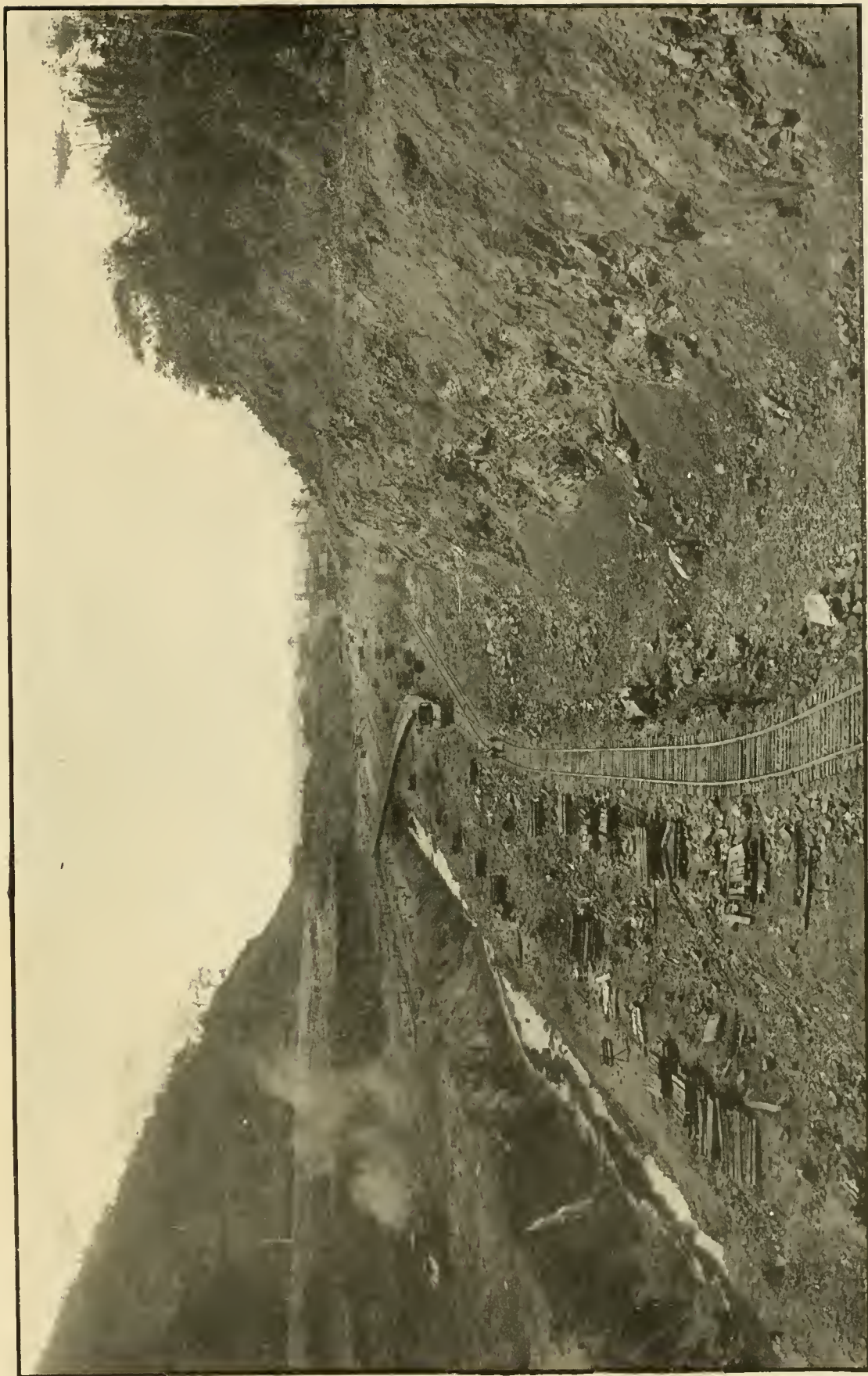
No changes in organization or in the personnel of the central division were made during the fiscal year ended June 30, 1912.

In conclusion, I wish to acknowledge my appreciation of the great interest shown by the division officials of all grades in the execution of their duties, for without their cordial cooperation and assistance it would not have been possible to accomplish the same results during the fiscal year.

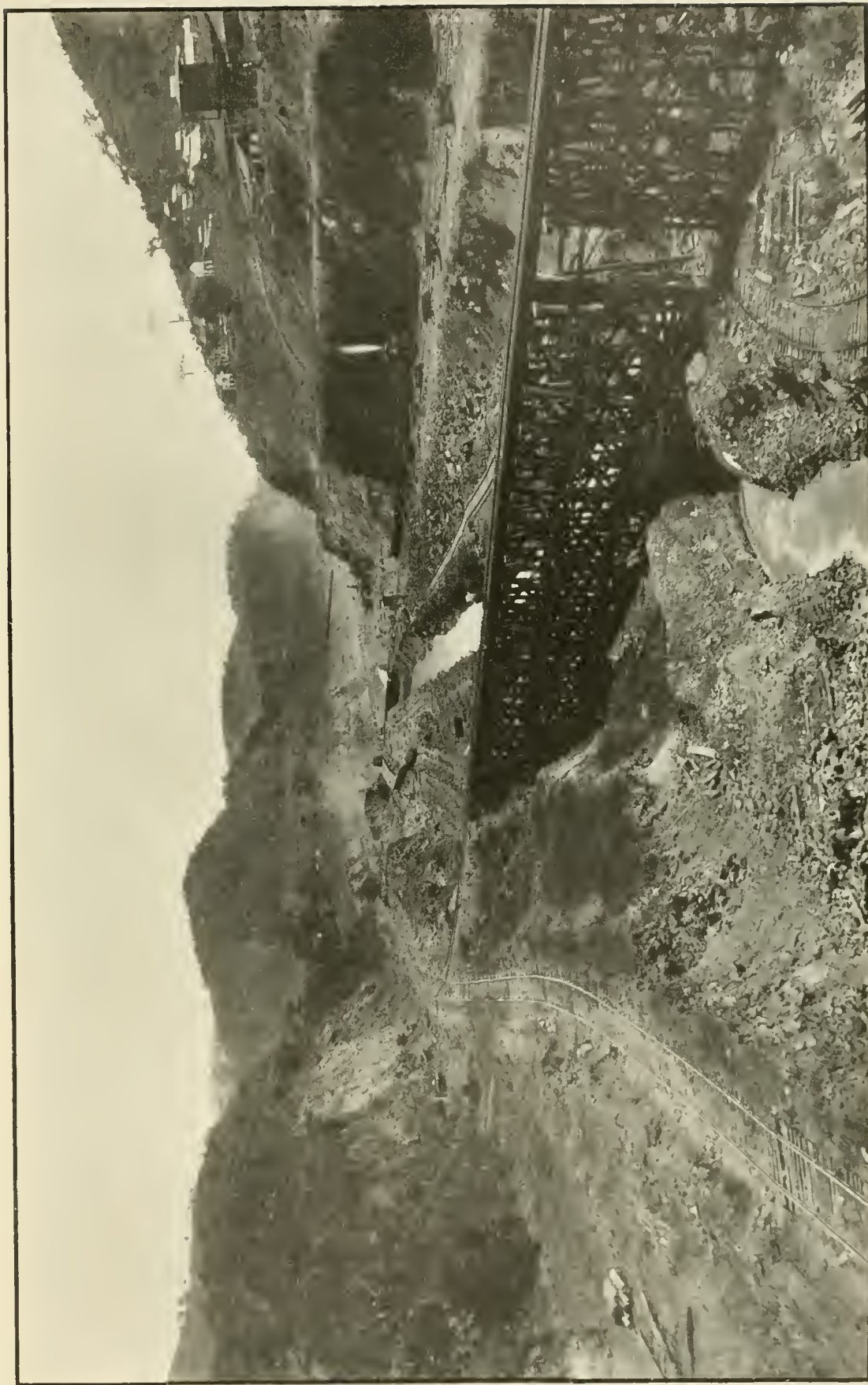
Respectfully submitted.

D. D. GAILLARD,
Lieutenant Colonel, Corps of Engineers, U. S. Army,
Member of Isthmian Canal Commission,
Division Engineer, Central Division.

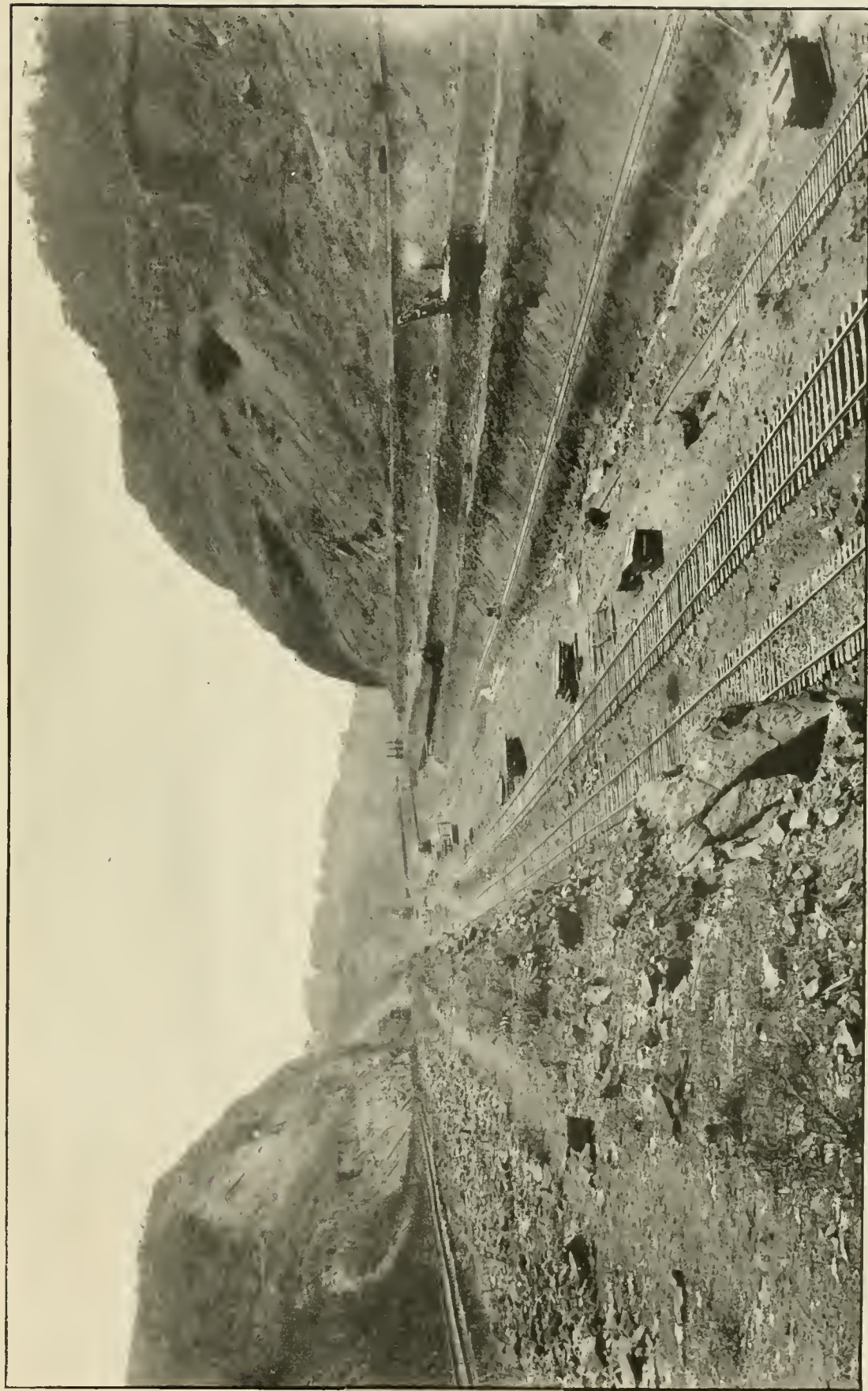
Col. GEORGE W. GOETHALS, *U. S. Army,*
Chairman and Chief Engineer, Culebra, Canal Zone.



CULEBRA CUT, SOUTH END, LOOKING SOUTH FROM BRIDGE 57½ AND SHOWING THE PARTLY COMPLETED ANCHORAGE BASIN NORTH OF PEDRO MIGUEL LOCK. TRAIN IS ON COMPLETED BOTTOM OF CANAL, ELEVATION +40. JUNE, 1912.

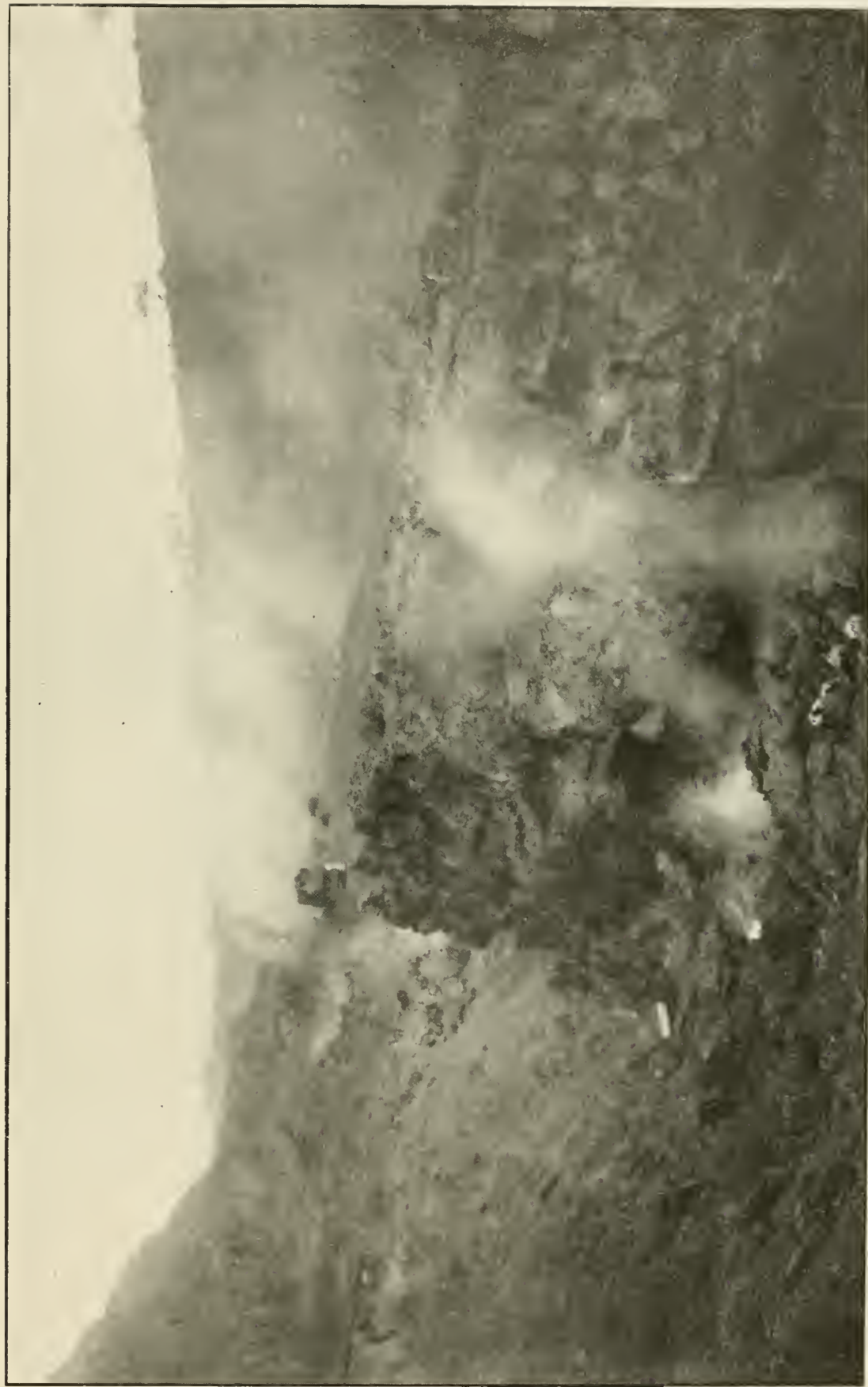


CULEBRA CUT LOOKING NORTH FROM BRIDGE 57 $\frac{1}{2}$, NEAR PARAISO. THE TRAIN ON THE LEFT, JUST BEYOND THE TRESTLE BRIDGE, IS ON THE COMPLETED BOTTOM OF THE CANAL, ELEVATION +40. JUNE, 1912.

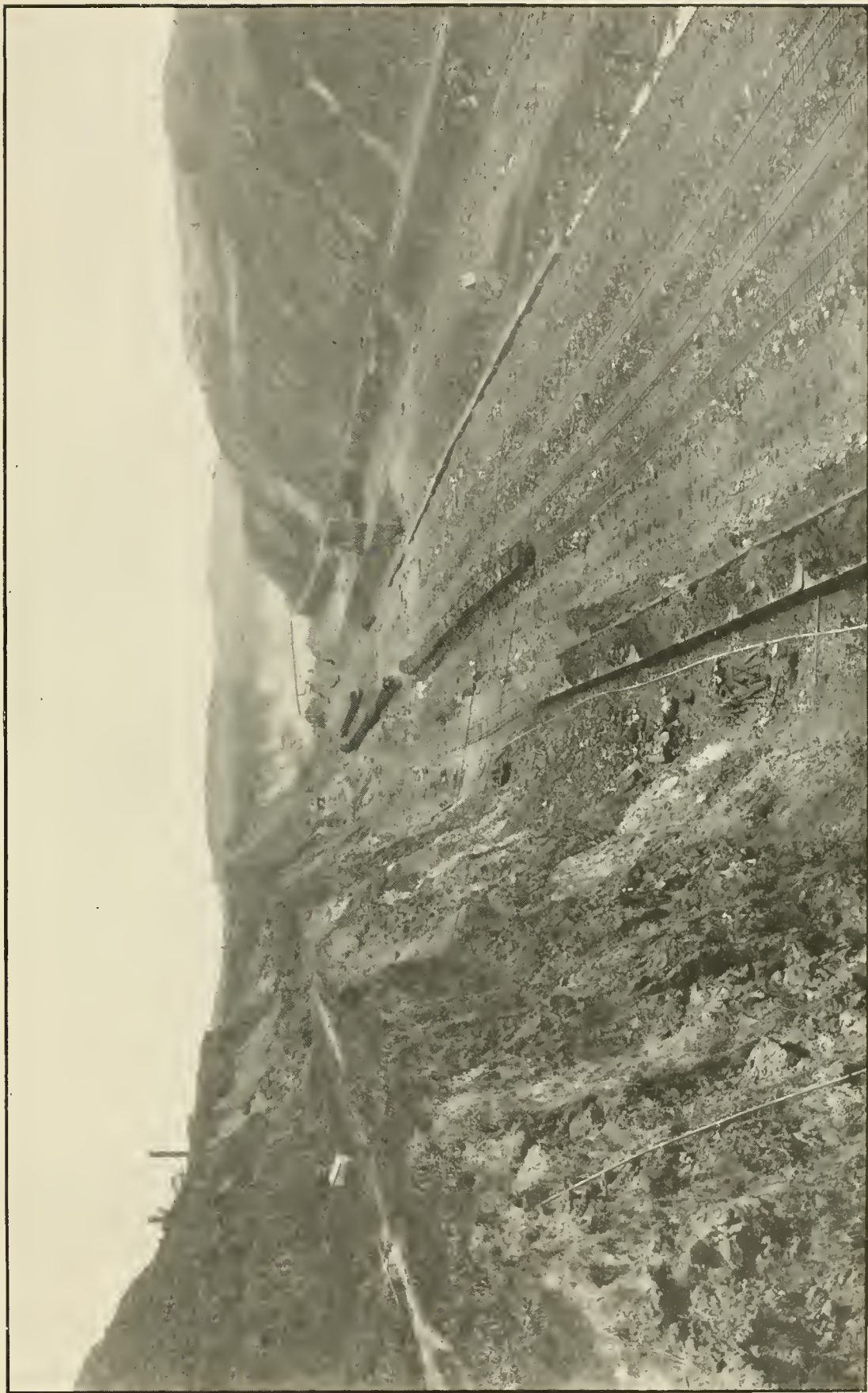


CULEBRA CUT LOOKING NORTH FROM A POINT SOUTH OF CONTRACTOR'S HILL, SHOWING QUIESCENT STATE OF CUCARACHA SLIDE ON RIGHT BANK. THE BOTTOM OF THE LOWEST STEAM SHOVEL CUT, AT A POINT OPPOSITE CONTRACTOR'S HILL, IS ABOUT 16 FEET ABOVE THE FINAL BOTTOM OF THE CANAL, OR ELEVATION +56. MAY, 1912.

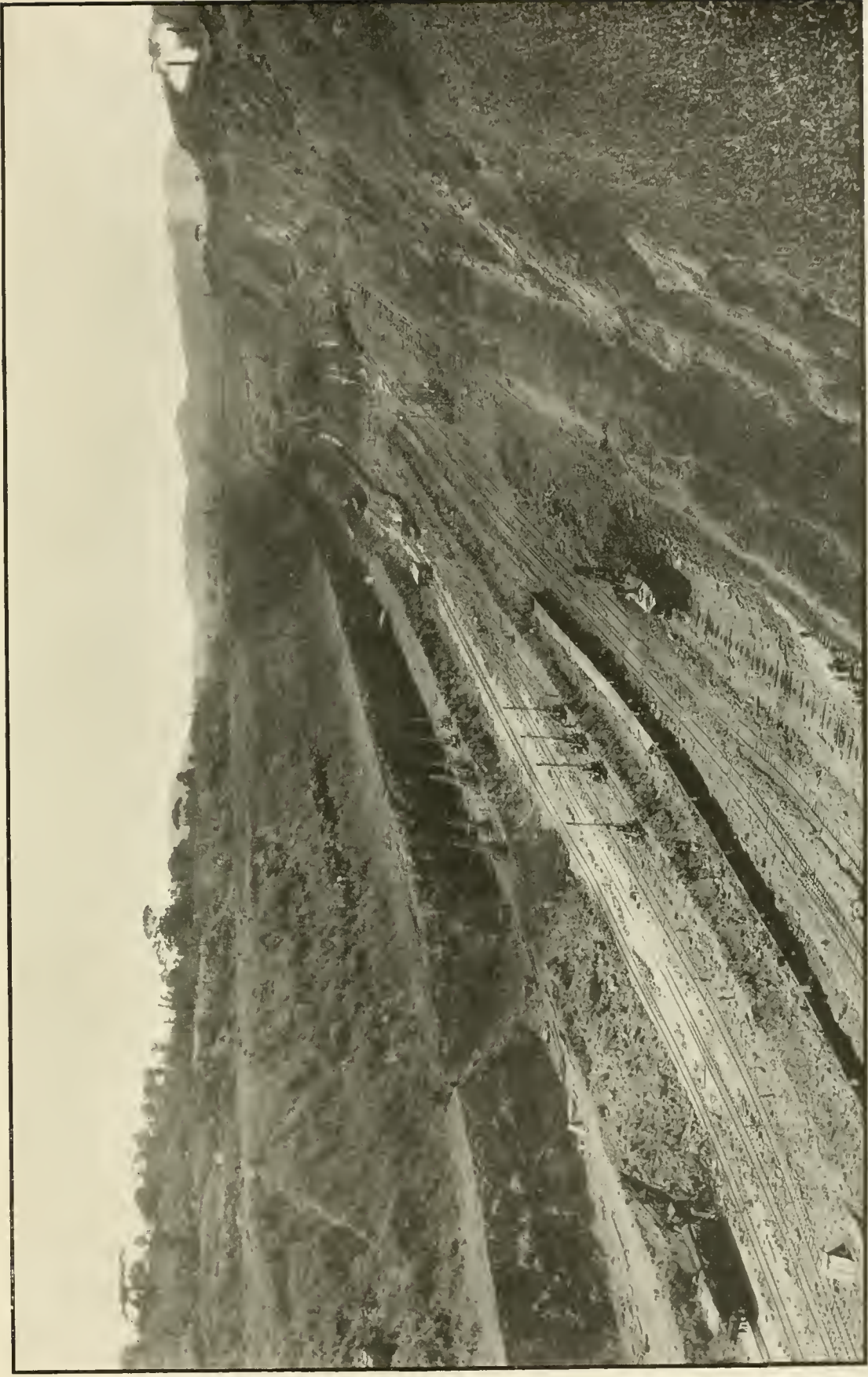
PLATE 31.



HEATED MATERIAL WEST SIDE OF CANAL, 350 YARDS NORTH OF CULEBRA Y. EXTENT OF HEATED MATERIAL 500' x 25' x 20'.
FEBRUARY 16, 1912.



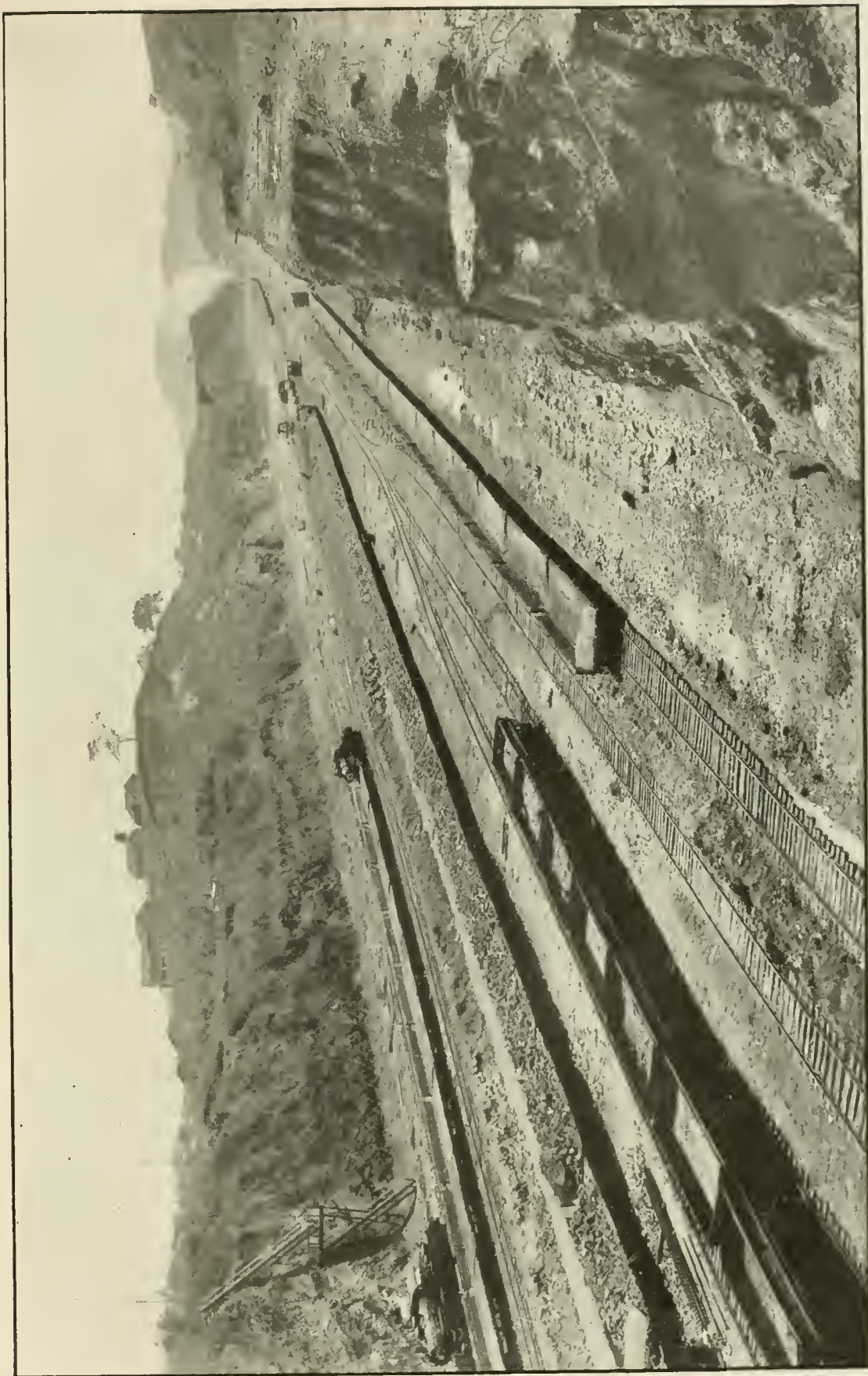
CULEBRA CUT LOOKING NORTH FROM EMPIRE SUSPENSION BRIDGE. THE NEAREST SHOVEL SHOWN, IN THE LOWEST CUT, IS WORKING ABOUT 12 FEET ABOVE THE BOTTOM, OR AT ELEVATION +52. MAY 1912.



CULEBRA CUT LOOKING SOUTH FROM CUNETTE. THE TWO SHOVELS SHOWN IN THE FOREGROUND ARE WORKING ON THE BOTTOM OF THE CANAL, ELEVATION +40. MAY, 1912.



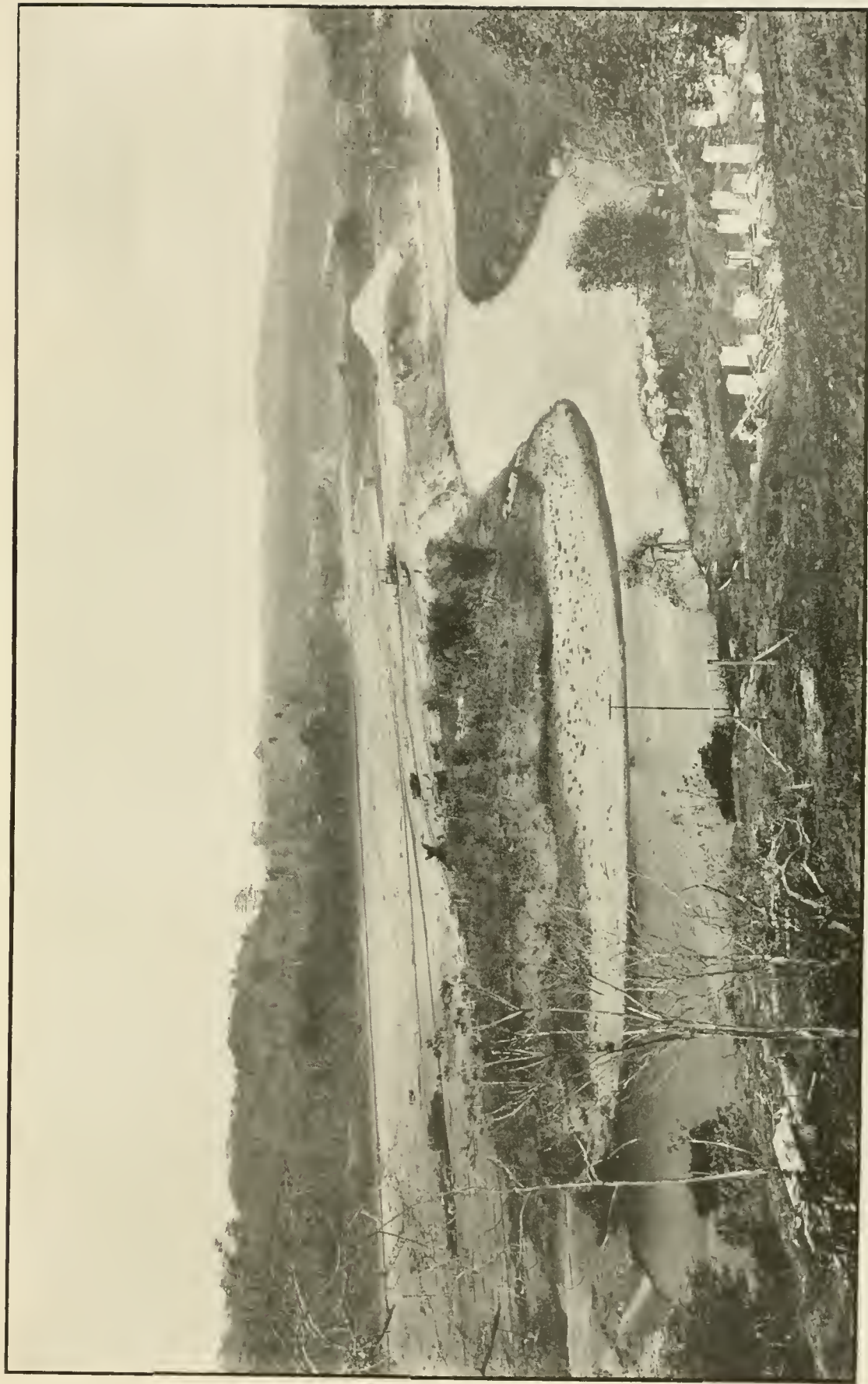
CULEBRA CUT LOOKING NORTH FROM CUNETTE. THE TWO SHOVELS SHOWN IN THE FOREGROUND ARE WORKING ON THE BOTTOM, ELEVATION +40. THE WATER STANDING IN THE CENTER DRAINAGE CHANNEL IS ABOUT 6 FEET BELOW THE BOTTOM, ELEVATION +34.



CULEBRA CUT LOOKING NORTH FROM LAS CASCADAS. ALL TRAINS ARE STANDING ON THE BOTTOM OF THE CUT, ELEVATION +40. MAY, 1912.

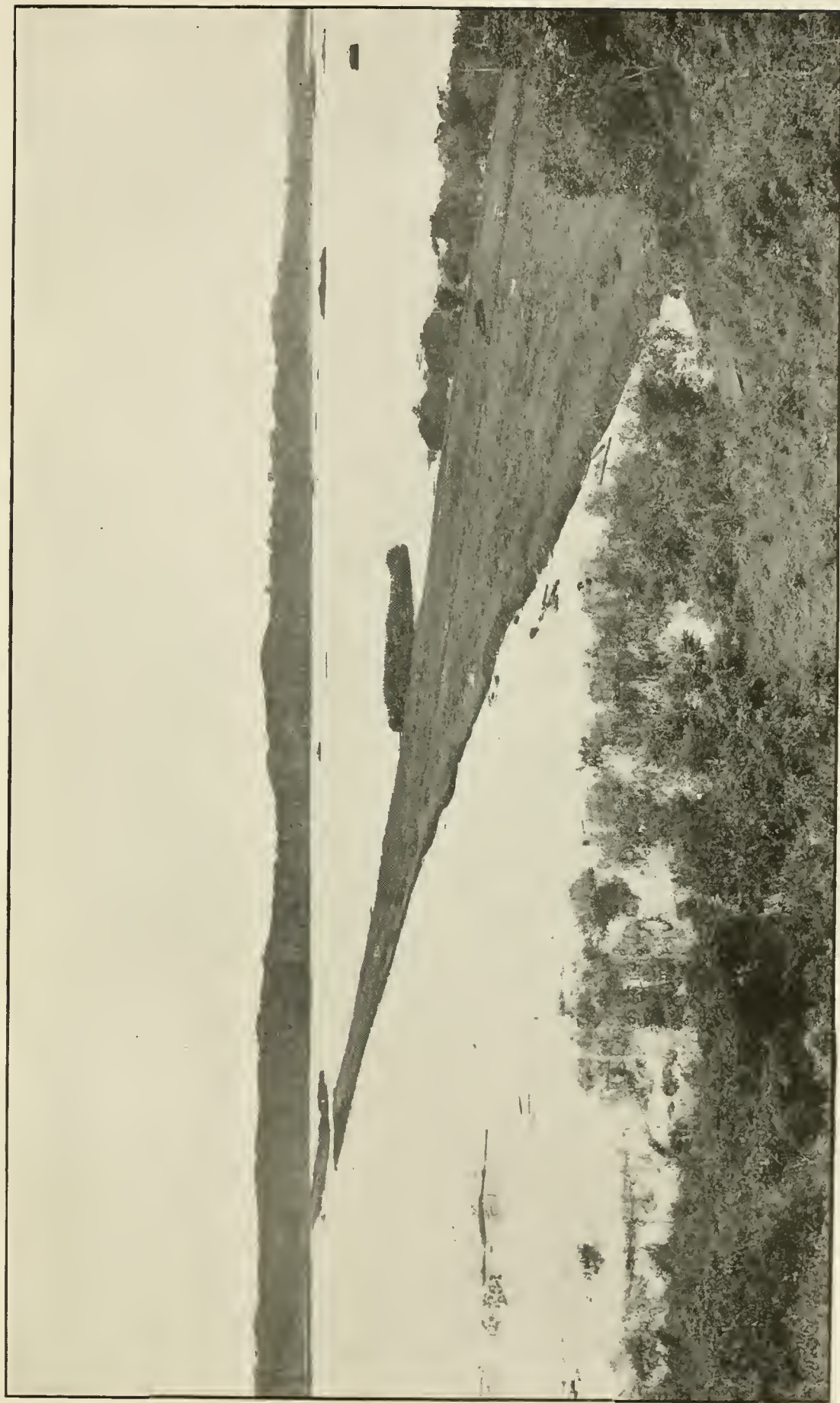


CULEBRA CUT LOOKING SOUTH FROM BEND IN EAST BANK NEAR GAMBOA. THE TRAIN AND SHOVEL ARE STANDING ON THE BOTTOM OF THE CUT. THE WATER IN THE DRAINAGE CHANNEL IS ABOUT 10 FEET BELOW THE BOTTOM OF THE CANAL, OR AT ELEVATION +30. JUNE, 1912.



CHANNEL EXCAVATED AT SAN PABLO DURING DRY SEASON, 1912. THIS CHANNEL IS COMPLETED AND IS 800 FEET WIDE, WITH
BOTTOM ELEVATION AT +40.

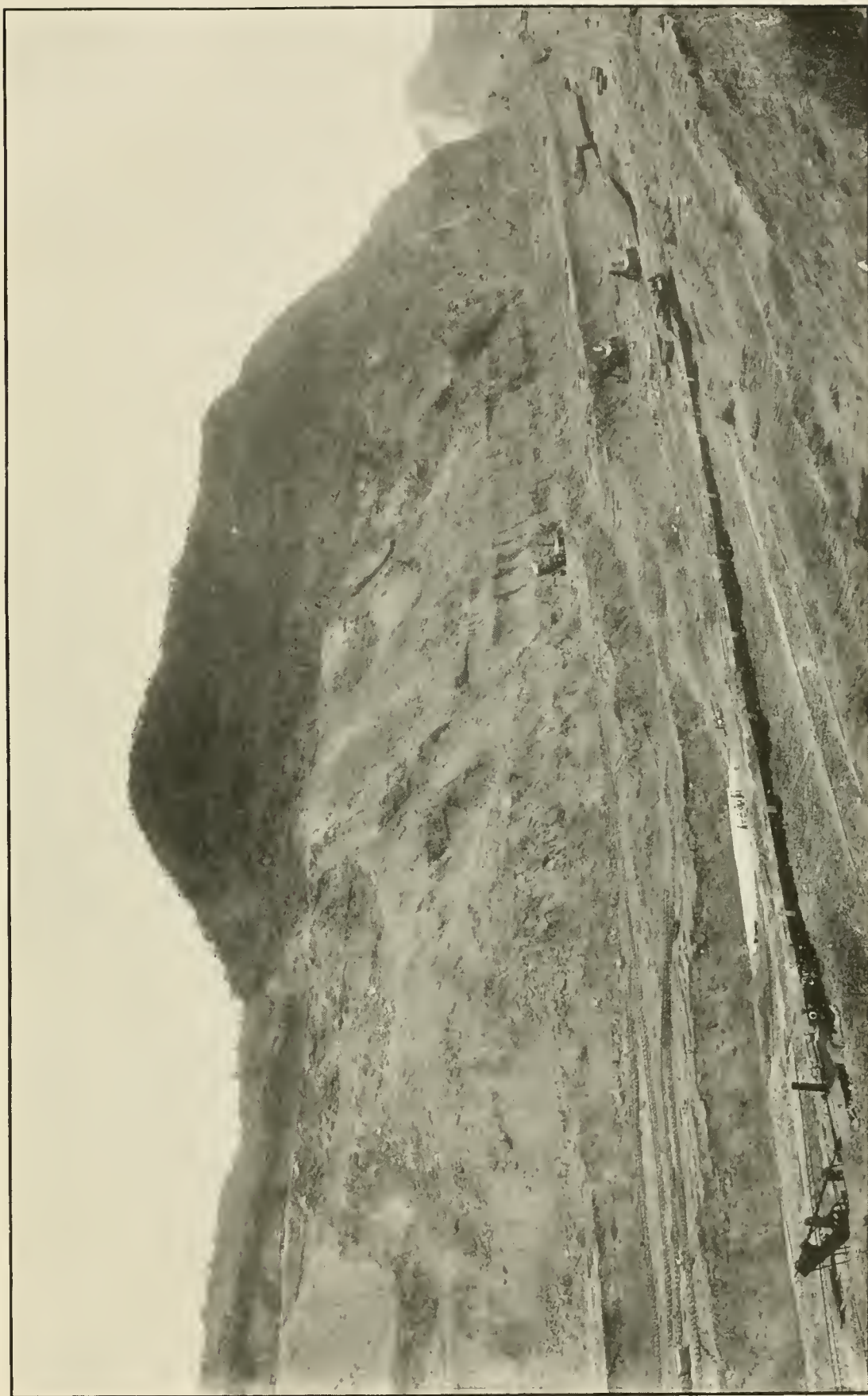
PLATE 39.



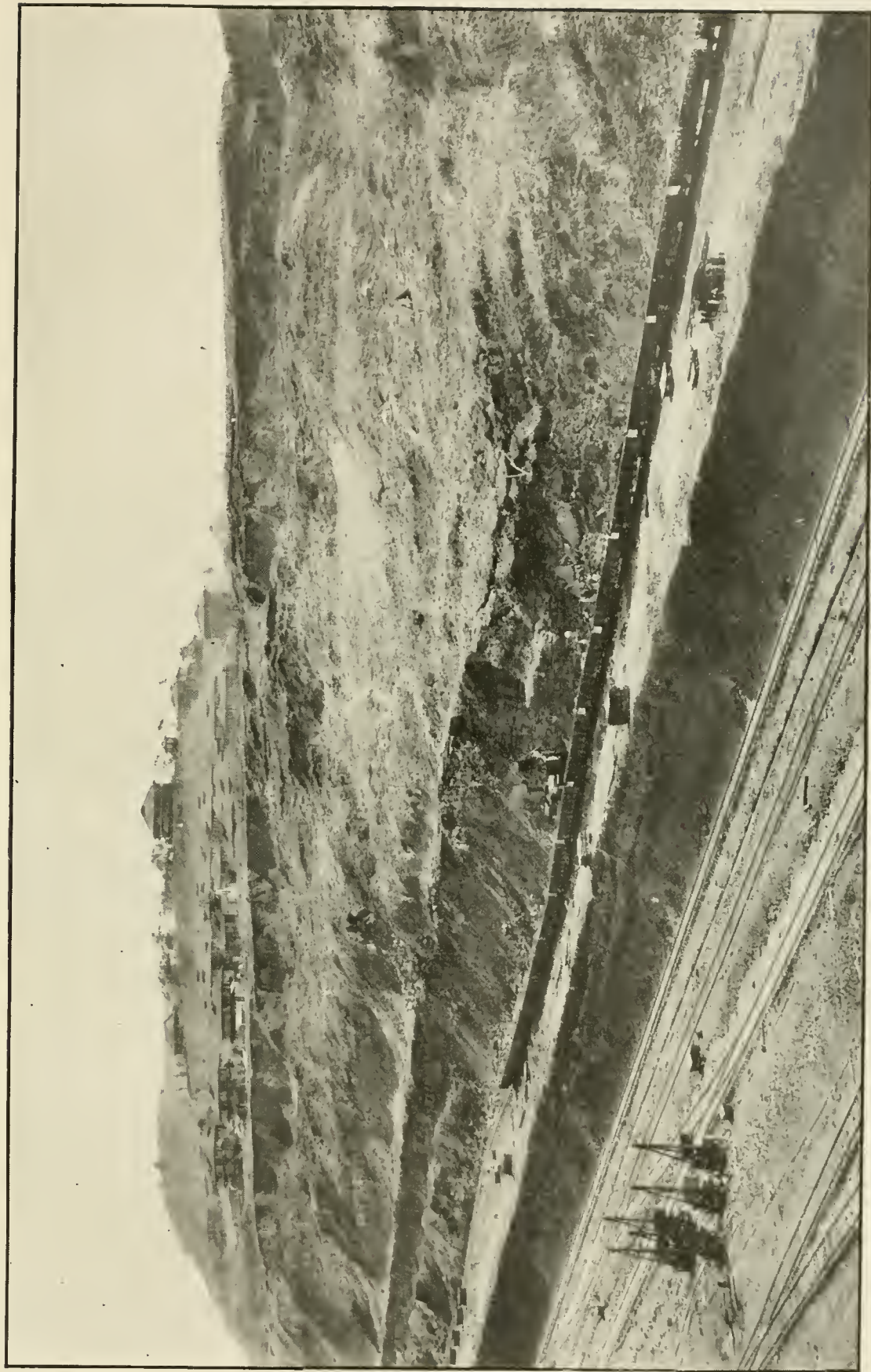
EMBANKMENT OF OLD PANAMA RAILROAD EXCAVATED DOWN TO +35 IN APRIL AND MAY, 1912.



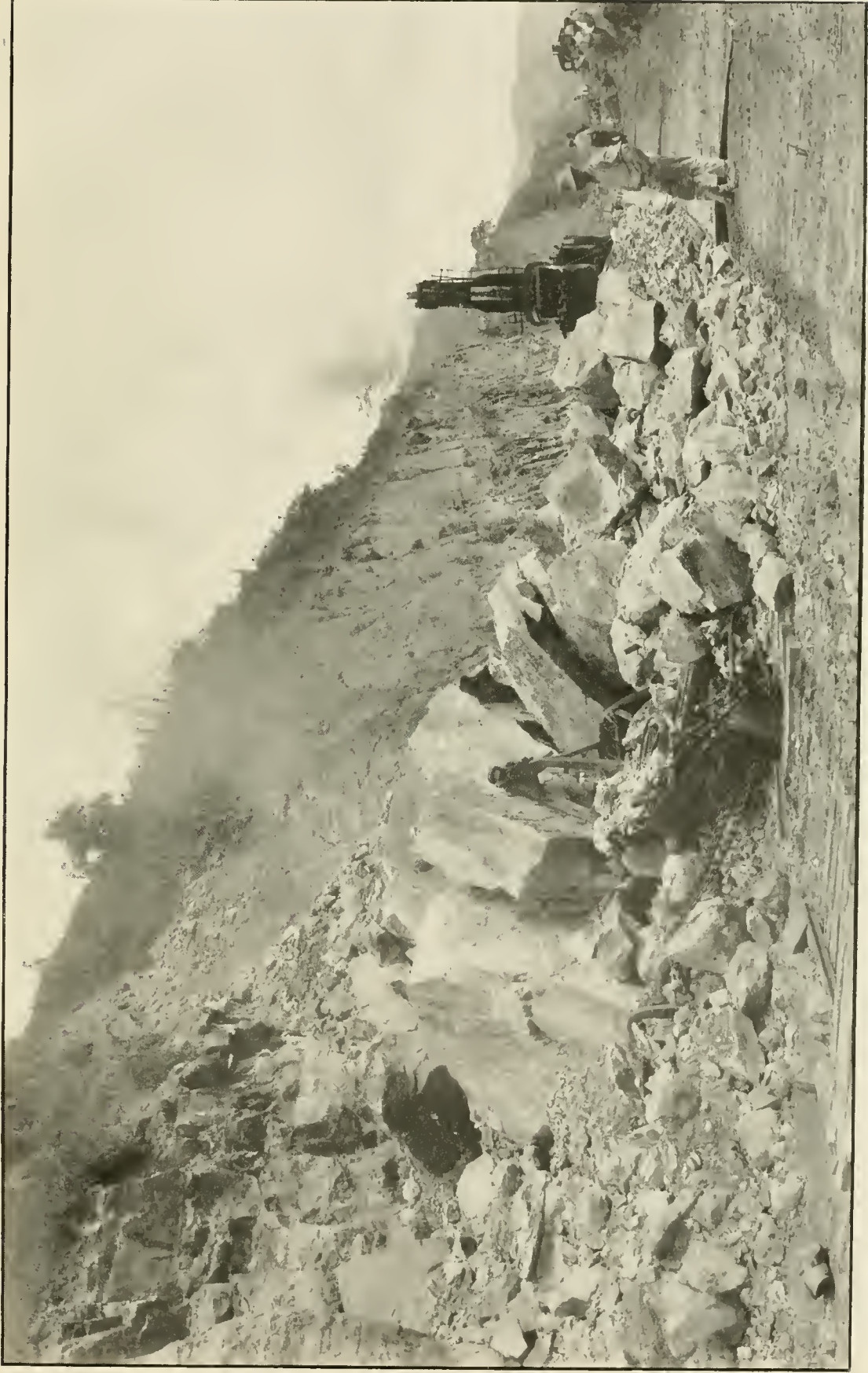
SLIDE IN EAST BANK OF CANAL NEAR CUCARACHA, JUNE, 1912. FOR PLAN AND CROSS SECTION OF THIS SLIDE SEE
PLATE 87.



CULEBRA CUT, CULEBRA. BREAK IN EAST BANK OF CANAL. AMOUNT OF MATERIAL INVOLVED, 320,000 CUBIC YARDS. THE TRAIN SHOWN IN FOREGROUND IS ABOUT 35 FEET ABOVE THE BOTTOM, OR AT ELEVATION +75. FEBRUARY 11, 1912.



SLIDE OF STRATIFIED ROCK, WEST BANK OF CANAL, CULEBRA-ON-THE-DUMP, LOOKING TOWARD CULEBRA. SLIDE INVOLVES ABOUT 1,000,000 CUBIC YARDS AND MOVED ABOUT 3 FEET PER DAY ON A SLOPE OF 1 VERTICAL TO 7 HORIZONTAL. THE TRAIN IS STANDING AT ELEVATION +95. FEBRUARY, 1912.

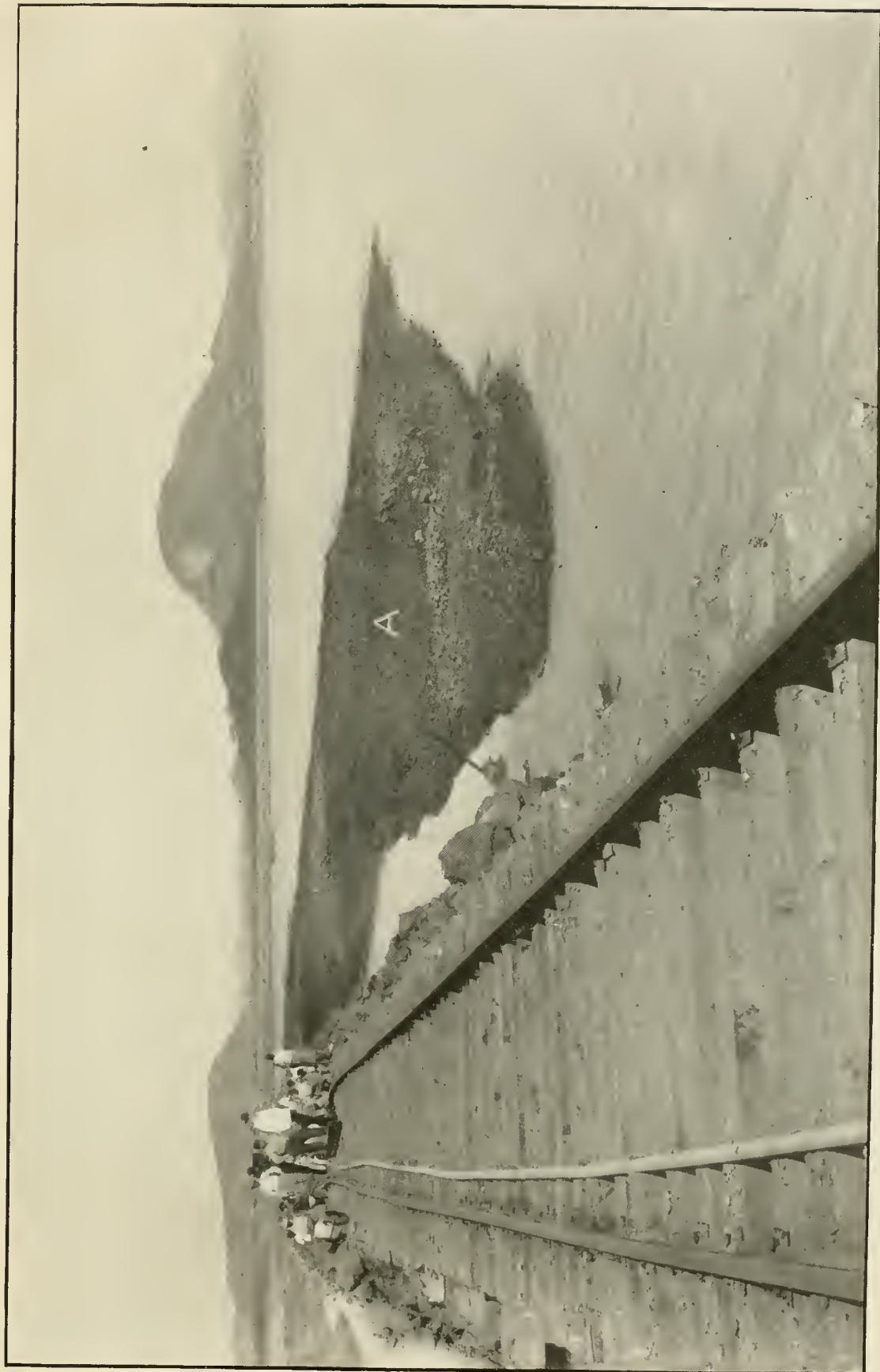


STEAM SHOVEL 218 BURIED UNDER FALL OF ROCK, WEST SIDE OF CANAL, NEAR LAS CASCADAS. THIS SHOVEL WAS WORKING ON THE BOTTOM OF THE CANAL WHEN DESTROYED, MAY 31, 1912.



SOUTH END OF NAOS ISLAND DUMP, 4,000 FEET FROM ISLAND. CENTER AT "A" IS 80 FEET FROM TRACK AND 25 FEET ABOVE THE ORIGINAL BOTTOM. ELEVATION OF TRESTLE, +14. DECEMBER, 1911.





SOUTH END OF NAOS ISLAND DUMP, 4,000 FEET FROM ISLAND. CENTER AT "A" IS 75 FEET FROM TRACK AND 25 FEET ABOVE THE ORIGINAL BOTTOM. ELEVATION OF TRESTLE, +14. DECEMBER, 1911.



APPENDIX D.

REPORT OF S. B. WILLIAMSON, DIVISION ENGINEER, PACIFIC DIVISION.

ISTHMIAN CANAL COMMISSION,
DEPARTMENT OF CONSTRUCTION AND ENGINEERING,
PACIFIC DIVISION, OFFICE OF THE DIVISION ENGINEER,
Corozal, Canal Zone, July 31, 1912.

SIR: I have the honor to submit the following report of operations in the Pacific division during the fiscal year ended June 30, 1912:

DIVISION ORGANIZATION.

The division extends from mile 39.53 immediately north of Pedro Miguel to deep water in the Pacific Ocean, a distance of 11 miles, and is subdivided as follows:

First district: Locks, dams, and dry excavation. Second district: Dredging, Balboa shops, and shipways. Third district: Municipal and sanitary engineering. Fourth district: Ancon quarry and crushing plant. Fifth district: Hydraulic excavation.

There has been no change during the past year in the organization, as shown by districts on plate 116.

A summary of the principal items of work performed is given in Table No. 1.

TABLE NO. 1.—*Principal items of work performed in year ended June 30, 1912.*

Class of work.	Unit.	Quantity.
Dry excavation:		
Work.....	Cubic yards.....	1,792,286
Plant.....	do.....	1,152,275
Terminals.....	do.....	23,140
Dredging excavation:		
Work—		
In canal prism.....	do.....	3,884,287
Inner basin.....	do.....	370,607
Lumber dock (charged Panama R. R.).....	do.....	300,518
Plant—		
Fortifications.....	do.....	18,550
Other.....	do.....	109,940
Hydraulic excavation, work.....	do.....	900,596
Explosives used.....	Gross tons.....	427.32
Rock drilling.....	Linear feet.....	1,000,349
Wash drilling.....	do.....	5,123
Diamond drilling.....	do.....	1,469
Construction tracks laid.....	Miles.....	50.95
Trestle bents framed.....	Number.....	175
Piles driven.....	do.....	920
Dam filling:		
Dry.....	Cubic yards.....	746,714
Wet.....	do.....	78,316
Back filling.....	do.....	830,238
Concrete placed in locks:		
Work.....	do.....	934,410
Plant.....	do.....	881
Concrete placed in dams, work.....	do.....	174
Rock crushed.....	do.....	839,279
Sand production.....	do.....	564,837
Roads maintained.....	Miles.....	21.7
Drains and ditches dug.....	Linear feet.....	116,044
Drains and ditches cleaned and graded.....	do.....	1,281,540
Permanent water pipe laid.....	do.....	65,265
Sewer pipe laid.....	do.....	12,798
Clearing and grubbing.....	Acres.....	129.75
Daily average force employed.....	Number.....	5,727.4

FIRST DISTRICT.

LOCKS, DAMS, AND DRY EXCAVATION.

[H. O. Cole, resident engineer.]

PEDRO MIGUEL LOCKS AND DAMS.

The work consisted in excavating; preparing the lock foundations; fabricating and erecting forms; placing concrete, and fixed irons for the valves, lock gates, fender chains and emergency dams; backfilling the lock walls, and filling the west dam.

LOCK EXCAVATION.

The excavation of the Pedro Miguel lock pit was completed in the fiscal year 1911, but the cost of excavating 95,156 cubic yards from the French dump east of the site, during the present year, has been charged to lock excavation, increasing the total to 1,099,121 cubic yards exclusive of the material removed in preparing the foundations.

TABLE NO. 2.—*Pedro Miguel lock excavation.*

[Cubic yards.]

Month.	Material exca- vated, earth.	Month.	Material exca- vated, earth.
1911.		1912.	
July.....		January.....	20,490
August.....		February.....	17,215
September.....		March.....	920
October.....		April.....	12,863
November.....	5,161	May.....	24,433
December.....	10,000	June.....	4,074
		Total.....	95,156

CONSTRUCTION TRACKS.

All construction tracks were maintained and relocated when necessary; 11.68 miles of new tracks were laid.

LOCK FOUNDATIONS.

Preparing the lock foundations involved the removal of loose rock, and the excavation below floor level, required for wall footings, lateral culverts, sills, sumps, etc. Under existing conditions a large portion was removed with picks and shovels, loaded into skips and handled into cars with locomotive cranes or derricks, though steam shovels have been employed when practicable; 38,826 cubic yards were handled during the year, and the total to date is 179,757 cubic yards.

TABLE NO. 3.—*Excavation for foundations, Pedro Miguel lock.*

[Cubic yards.]

Month.	Material excavated.		
	Earth.	Rock.	Total.
1911.			
July.....		6,273	6,273
August.....		220	220
September.....		3,472	3,472
October.....		5,365	5,365
November.....		7,801	7,801
December.....		6,170	6,170
1912.			
January.....		3,484	3,484
February.....		1,265	1,265
March.....		857	857
April.....		406	406
May.....	953	632	1,585
June.....	1,928	.....	1,928
Total.....	2,881	35,945	38,826

PLACING CONCRETE.

The total amount of concrete placed in the Pedro Miguel locks during the fiscal year is 182,870 cubic yards, mixed entirely by the auxiliary plant. The latter consisted of one 2-cubic yard mixer located at the south end of the east wall until September 25; two 2-cubic yard mixers installed at the south end of the west storage trestle in the forebay, one of which was removed on March 15, and an average of 3.16½ cubic yard mixers which have been moved about as considered most advantageous. At the beginning of the fiscal year the construction plant has been moved to Miraflores, with the exception of two chamber cranes; the dismantling of these began on December 12 and February 7, respectively. Prior to these dates they were employed for setting iron work, back-filling the center wall, and placing 28,450 cubic yards of the concrete mixed by the auxiliary plant. The remaining 154,420 cubic yards were either handled by locomotive cranes and derricks or poured into the forms from the half-yard mixers. The total yardage for the year is made up of 134,193 cubic yards of plain concrete and 48,677 cubic yards of reinforced.

Revised estimates made on July 1, 1912, showed an increase of 61,761 cubic yards in the total amount of concrete previously estimated for these locks; the amount placed prior to June 30, 1912, is 847,925 cubic yards and the estimated amount remaining is 51,150 cubic yards. The progress is shown graphically on plate 89 and the performances of the plant are given in the tables following.

TABLE NO. 4.—Performance of chamber cranes at Pedro Miguel, 1911-12.

[Quantities in this table are "Bucket measurements."]

Month.	Number of cranes.	Material placed.			Service time.							Rates per hour per crane.		Working time to time in service.
		Concrete.	Fill.	Total.	Hours working.		Hours delay.				Total hours per month.	Placing time.	Total time.	
					Placing concrete and fill.	Handling forms, steel, etc.	Repairs to cranes.	Waiting for concrete.	Waiting for forms.	Other delays.				
1911.		<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>								<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Per ct.</i>
July.....	1.96	7,126	.....	7,126	133.97	106.59	14.72	69.02	87.29	29.41	441.00	53.2	16.2	0.5455
August....	1.89	4,660	.....	4,660	103.58	160.32	7.84	36.94	107.42	42.90	459.00	44.9	10.2	.5749
September	2.00	2,374	.....	2,374	69.26	257.33	6.09	28.83	70.50	17.99	450.00	34.3	5.3	.7258
October....	2.00	6,459	.....	6,459	153.70	228.34	29.50	28.23	38.00	44.23	522.00	42.0	12.4	.7319
November	2.00	6,009	.....	6,009	139.34	191.38	7.51	61.16	16.10	16.51	432.00	43.2	13.9	.7655
December.	1.08	1,116	1,362	2,478	141.58	21.83	9.42	31.75	46.67	81.75	333.00	17.5	7.4	.4907
1912.														
January...	1.00	706	1,220	1,926	89.82	20.92	12.25	5.58	1.08	177.09	306.74	21.4	6.3	.3610
Total.	1.72	28,450	2,582	31,032	831.25	986.71	87.33	261.51	367.06	409.88	2,943.74	37.3	10.5	.6176

TABLE NO. 5.—Performance of auxiliary concrete plant, Pedro Miguel, 1911-12.

Month.	Mixers used.		Working days.	Working time (hours).		Concrete placed (cubic yards).		
	Average number.	Size (cubic yards).		Total.	Per day.	Total.	Per day.	Per mixer hour.
1911.								
July.....	2.96	2	25	420.00	16.80	16,333	653.32	38.9
	2.16	$\frac{1}{2}$	25	289.85	11.59	4,059	162.36	14.0
August.....	3.00	2	27	445.50	16.50	15,896	588.74	35.7
	2.19	$\frac{1}{2}$	27	291.59	10.80	4,741	175.59	16.3
September.....	2.76	2	25	367.00	14.68	13,088	523.52	35.7
	1.80	$\frac{1}{2}$	20	125.98	6.30	2,301	115.05	18.3
October.....	2.88	2	26	446.00	17.15	16,371	629.65	36.7
	3.35	$\frac{1}{2}$	26	491.72	18.91	8,541	328.50	17.4
November.....	3.00	2	24	374.00	15.58	14,220	592.50	38.0
	2.92	$\frac{1}{2}$	24	668.00	27.83	5,423	225.95	8.1
December.....	2.40	2	25	318.00	12.72	10,494	419.76	33.0
	2.00	$\frac{1}{2}$	25	293.75	11.75	4,012	160.48	13.7
1912.								
January.....	2.00	2	26	306.42	11.79	10,122	389.31	33.3
	2.85	$\frac{1}{2}$	26	450.08	17.31	4,960	190.77	11.0
February.....	2.00	2	24	230.00	9.58	7,666	319.42	33.3
	4.00	$\frac{1}{2}$	24	578.83	24.12	5,352	223.00	9.2
March.....	1.73	2	26	161.00	6.19	5,490	211.15	34.3
	3.38	$\frac{1}{2}$	26	427.58	16.45	3,967	152.58	9.3
April.....	1.00	2	25	127.50	5.10	5,225	209.00	40.9
	3.60	$\frac{1}{2}$	25	401.50	16.06	4,235	169.40	10.6
May.....	1.00	2	26	100.75	3.88	3,948	151.85	38.3
	4.73	$\frac{1}{2}$	26	617.50	23.75	6,645	255.58	10.8
June.....	1.00	2	25	95.50	3.82	3,644	145.76	38.0
	4.96	$\frac{1}{2}$	25	658.50	26.34	6,251	250.04	9.5
Totals:								
2-yard mixers.....	2.14	2	304	3,391.67	11.16	122,497	402.95	36.1
$\frac{1}{2}$ -yard mixers.....	3.16	$\frac{1}{2}$	299	5,294.88	17.71	60,487	202.30	11.4

NOTE.—Quantities in above table are "bucket measurements." Seventy-four yards of concrete, mixed at this plant, were placed in Pedro Miguel West Dam.

CONCRETE FORMS.

The forming used has been described in previous reports, excepting the type employed for the reenforced concrete guide walls; these are shown in detail on plate 90.

BACK FILLING.

Back filling the walls at Pedro Miguel was continued throughout the year and the following accomplished :

TABLE No. 6.—Back filling Pedro Miguel lock walls.

Location.	Number of cubic yards of filling.			Per cent completed.
	This year.	Previous years.	Total.	
East wall.....	186,518	50,838	237,356	53
Center wall.....	21,937	1,434	23,371	11
West wall.....	162,757	231,053	393,810	85
Total.....	371,212	283,325	654,537	58

FILLING WEST DAM.

The drainage from the central division was turned through the center-wall culvert at Pedro Miguel on August 15. When this drainage was diverted from the site of the west dam filling was resumed, and 321,589 cubic yards have been added in the past year. The dam is 87 per cent completed. The excavation for the concrete core wall to connect the dam with the wing wall of the lock was begun and is 95 per cent completed.

MIRAFLORES LOCKS AND DAMS.

The lock excavation, construction of west dam, erection of concrete-handling plant, preparing foundation, and placing concrete were continued during the year.

LOCK EXCAVATION.

The total amount of material excavated from the locks in the fiscal year was 624,747 cubic yards, exclusive of preparing foundation. Of this, 364,767 cubic yards were used for back filling and 259,980 cubic yards were placed in the toes of the west dam.

TABLE No. 7.—Miraslores Lock excavation.

[Cubic yards.]

Month.	Material excavated.		
	Earth.	Rock.	Total.
1911.			
July.....	95,464		95,464
August.....		99,309	99,309
September.....	9,100	84,435	93,535
October.....	5,000	99,970	104,970
November.....	6,111	53,014	59,125
December.....		52,000	52,000
1912.			
January.....	680	72,410	73,090
February.....	3,187	26,880	30,067
March.....		8,087	8,087
April.....	809	7,421	8,230
May.....		870	870
June.....			
Total.....	120,351	504,396	624,747

CONSTRUCTION TRACKS.

In addition to maintaining and moving tracks as required, 39.27 miles of new construction tracks were laid in connection with the work at Miraflores.

LOCK FOUNDATIONS.

The surface of the rock on which the Miraflores Locks are founded dips rapidly at the north end of the site. The walls were originally located with their northern extremities resting on the rock at an elevation of only a few feet below the desired grade. Subsequent changes in the design of the locks necessitated extending the walls 98 feet farther north, which not only increased the amount and depth of excavation required to secure suitable foundations, but added materially to the difficulties and cost, in that the additional work had to be done in a confined space below the surface water level, and it was necessary to move a number of construction tracks which had been located according to the original plan.

In performing this work and preparing the lower lock foundations 165,145 cubic yards were removed.

TABLE No. 8.—*Excavation for foundations, Miraflores Locks.*

[Cubic yards.]

Month.	Material excavated.		
	Earth.	Rock.	Total.
1911.			
July.....		2,420	2,420
August.....		2,940	2,940
September.....		2,577	2,577
October.....		2,820	2,820
November.....	781	24,988	25,769
December.....	5,327	22,153	27,480
1912.			
January.....	2,135	20,384	22,519
February.....	2,009	15,350	17,359
March.....	2,200	18,065	20,265
April.....	6,817	14,047	20,864
May.....	2,632	9,594	12,226
June.....	4,931	2,975	7,906
Total.....	26,832	138,313	165,145

CONCRETE HANDLING PLANT.

The construction plant consists of the four berm and four chamber cranes described in the Annual Report of 1910. The arrangement of the cranes at Miraflores has been altered somewhat from that originally contemplated as is shown on plates 91 and 92. Instead of erecting two chamber cranes in each lock chamber and supplying them with concrete for the center wall, from the berm cranes, the four cranes were placed in the east chambers and supplied from stationary mixing plants, consisting of two 2-cubic-yard mixers, located in openings left in the east wall. The concrete is delivered to the cranes by the narrow-gauge equipment used at Pedro Miguel, operating over tracks laid on the lock floors. Two cranes were erected in the upper and two in the lower chamber; after completing the upper lock walls one of the former cranes was jacked down to the lower level and

at present there are three cranes operating in the lower lock. The modified arrangement increased the output of the plant and obviated the necessity of lowering all of the chamber cranes from the upper to the lower chambers.

On June 30, 1911, there were two berm cranes in operation at Miraflores. The other two were put in commission on July 25 and October 28, respectively. The assembling of the four chamber cranes was not completed until after the beginning of the fiscal year and they began placing concrete on July 13, August 3, February 15, and March 26, respectively. They were supplied by two 2-cubic-yard mixers located in the east wall of the upper lock; these mixers were removed on June 15, 1912, and subsequently the cranes have been served by a similar mixing plant installed in the east wall of the lower lock. In addition to the above, an average of $4.24\frac{1}{2}$ cubic-yard portable mixers have been used throughout the year, mainly in constructing the walls in the forebay and the upper, reenforced concrete guide wall.

PLACING CONCRETE.

The aggregate amount of concrete placed in the Miraflores Locks in the past year is 751,540 cubic yards, made up of 729,096 cubic yards of plain and 22,444 cubic yards of reenforced concrete. The construction and auxiliary plants placed 401,079 cubic yards and 350,461 cubic yards, respectively. The progress is shown graphically on plate 93, and the performance records are given in the following tables:

TABLE No. 9.—Performance of berm cranes at Miraflores, 1911-12.

Date.	Number of cranes.		Concrete mixed (cubic yards).	Service time of cranes.							Rate per hour per crane (cubic yards).		Working hours to total hours (efficiency).
	Number of mixers (2 cubic yards).	Working hours.		Hours delay.				Total hours.	Mixing and placing hours.	Total hours.			
		Mixing and placing.		Handling forms, steel, etc.	Repairs to cranes.	Repairs to mixers.	Waiting for forms.				Other delays.		
1911.													
July.....	2.24	4.20	25,326	273.45	46.87	53.58	5.50	61.17	63.43	504.00	92.6	50.2	0.6356
August.....	3.00	5.26	33,726	387.21	49.28	67.90	4.00	97.65	122.96	729.00	87.4	46.3	.5987
September....	2.88	5.28	25,349	309.07	22.68	44.94	3.00	158.84	109.47	648.00	82.0	39.1	.5120
October.....	3.04	5.85	26,200	367.09	27.92	45.64	1.00	148.34	121.01	711.00	71.4	36.8	.5556
November....	4.00	7.00	19,427	373.50	61.00	45.25	2.50	262.75	129.00	864.00	52.0	22.5	.5017
December...	4.00	6.64	31,180	560.15	72.70	47.69	6.92	136.32	125.22	949.00	55.7	32.9	.6669
1912.													
January.....	4.00	6.31	37,054	592.76	119.98	42.00	4.18	147.36	156.72	1,063.00	62.5	34.9	.6705
February.....	4.00	7.83	47,120	645.15	58.07	42.41	7.00	116.41	114.96	984.00	73.0	47.9	.7147
March.....	4.00	8.00	49,584	670.50	49.95	41.26	2.01	62.23	233.05	1,059.00	74.0	46.8	.6803
April.....	4.00	8.00	47,630	641.17	53.44	38.14	.....	36.41	256.51	1,025.67	74.4	46.4	.6766
May.....	4.00	7.80	42,764	619.73	53.69	33.81	4.68	77.18	267.74	1,056.83	68.7	40.4	.6372
June.....	3.84	6.44	24,291	387.53	68.28	31.83	6.58	169.84	244.44	908.50	62.2	26.8	.5016
Totals:													
Cranes...	3.58	.....	409,651	5,827.31	683.86	534.45	47.37	1,474.50	1,944.51	10,512.00	70.3	39.0	.6194
Mixers...	6.55	.....	409,651	10,763.85	.....	.....	.....	.....	.....	19,287.99	38.1	21.2	1.5581

¹ In figuring the efficiency for mixers the "mixing and placing" time only is considered the working hours. Quantities in this table are "bucket measurement." One hundred yards of concrete mixed by cranes were placed in core wall of west dam.

TABLE No. 10.—Performance of chamber cranes at Miraflores, 1911-12.

[Quantities in this table are "Bucket measurements."]

Month.	Number of cranes.	Material placed (cubic yards).			Service time.							Rate per hour per crane (cubic yards).		Working time to time in service.	
		Concrete.	Fill.	Total.	Hours working.		Hours delay.				Total hours per month.	Placing time.	Total time.		
					Placing con- crete and fill.	Handling forms, steel, etc.	Repairs to cranes.	Waiting for concrete.	Waiting for forms.	Other de- lays.					
1911.															
July.....	1.00	7,722	.....	7,722	122.90	0.50	4.44	11.99	1.34	2.83	144.00	62.8	53.6	0.8569	
August.....	1.90	23,460	.....	23,460	404.78	6.82	28.45	17.78	6.75	9.42	474.00	57.9	49.5	.8683	
September..	2.00	27,536	.....	27,536	413.69	1.87	14.93	34.83	.....	3.68	469.00	66.6	58.7	.8860	
October.....	2.00	24,486	.....	24,486	419.85	6.75	5.67	40.98	16.75	3.50	493.50	58.3	49.6	.8644	
November..	1.92	14,782	.....	14,782	293.91	24.46	11.68	32.83	65.72	8.40	437.00	50.3	33.8	.7281	
December..	1.96	10,698	.....	10,698	226.72	45.17	4.34	40.96	107.38	32.76	457.33	47.2	23.4	.5945	
1912.															
January....	1.96	4,244	.....	4,244	105.74	160.90	.92	18.59	94.18	78.67	459.00	40.1	9.2	.5809	
February....	2.50	8,299	.....	8,299	192.76	76.51	3.67	57.56	174.66	34.84	540.00	43.1	15.4	.4986	
March.....	3.20	18,024	.....	18,024	292.77	141.46	11.25	111.16	196.51	72.65	825.80	61.6	21.8	.5259	
April.....	4.00	29,238	.....	29,238	481.93	96.97	33.42	182.74	189.49	57.95	1,042.50	60.7	28.2	.5553	
May.....	3.90	32,904	.....	32,904	533.22	70.75	27.18	145.91	225.00	75.27	1,077.33	61.7	30.5	.5614	
June.....	2.92	33,127	7,342	40,469	654.96	42.01	24.82	170.82	13.74	161.15	1,067.50	61.8	37.9	.6529	
Total.	2.44	234,520	7,342	241,862	4,143.23	674.17	170.77	866.15	1,091.52	541.12	7,486.96	58.4	32.3	.6434	

TABLE No. 11.—Performance of auxiliary concrete plant at Miraflores, 1911-12.

[Quantities used in this table are "Bucket measurements."]

Month.	Mixers used.		Working days.	Working time (mixer hours).		Concrete placed (cubic yards).		
	Average number.	Size (cubic yards).		Total.	Per day.	Total.	Per day.	Per mixer hour.
1911.								
July.....	1.94	2	16	180.42	11.28	7,768	485.50	43.1
	2.60	$\frac{1}{2}$	25	420.20	16.81	5,147	205.88	12.2
August.....	2.00	2	27	373.80	13.84	23,512	870.80	62.9
	1.81	$\frac{1}{2}$	27	307.83	11.40	3,718	137.70	12.1
September.....	2.00	2	25	379.73	15.19	27,874	1,114.96	73.4
	3.00	$\frac{1}{2}$	23	425.15	18.48	4,927	214.22	11.6
October.....	2.00	2	26	378.01	14.54	26,406	1,015.61	69.9
	3.85	$\frac{1}{2}$	26	634.50	24.40	9,058	348.38	14.3
November.....	1.83	2	24	228.60	9.53	15,536	647.33	67.9
	3.38	$\frac{1}{2}$	24	541.25	22.55	6,900	290.00	12.9
December.....	1.92	2	26	190.30	7.32	12,322	473.92	64.7
	2.88	$\frac{1}{2}$	25	401.25	16.05	5,296	211.84	13.2
1912.								
January.....	1.61	2	23	95.62	4.16	6,360	276.52	66.5
	2.31	$\frac{1}{2}$	26	364.50	14.02	5,605	215.58	15.4
February.....	2.00	2	24	151.92	6.33	9,682	403.42	63.7
	4.04	$\frac{1}{2}$	24	591.59	24.65	8,402	350.08	14.2
March.....	2.00	2	26	312.99	12.04	20,404	784.77	65.2
	7.50	$\frac{1}{2}$	26	1,191.43	45.82	15,310	588.85	12.9
April.....	2.00	2	25	448.68	17.95	30,596	1,223.84	68.6
	8.32	$\frac{1}{2}$	25	1,341.50	53.66	18,097	723.88	13.5
May.....	2.88	2	26	554.13	21.31	36,486	1,403.31	66.9
	5.54	$\frac{1}{2}$	26	936.00	36.00	12,999	499.96	13.9
June.....	2.88	2	25	526.65	21.07	36,504	1,460.16	69.3
	5.68	$\frac{1}{2}$	25	887.00	35.48	8,892	355.68	10.0
Totals:								
2-yard mixers.....	2.09	2	293	3,820.85	13.04	253,450	865.02	66.3
$\frac{1}{2}$ -yard mixers.....	4.24	$\frac{1}{2}$	302	8,042.20	26.63	104,411	345.73	13.0

TABLE NO. 12.—Concrete and fixed irons placed in Pacific locks.

	Concrete (cubic yards).			Fixed irons (pounds).
	Plain.	Reinforced.	Total.	
Pedro Miguel:				
This year.....	134,193	48,677	182,870	2,376,472
Previous years.....	634,670	385	665,055	7,063,915
Total.....	798,863	49,062	847,925	9,440,387
Miraflores:				
This year.....	729,096	22,444	751,540	5,962,085
Previous years.....	274,563	.....	274,563	.....
Total.....	1,003,659	22,444	1,026,103	5,962,085

CONCRETE FORMS.

The forming is similar to that used at Pedro Miguel and has been described and illustrated in previous reports.

WEST DAM.

The hydraulic filling was completed on December 4, 1911; it contains 625,048 cubic yards, of which 78,316 cubic yards were pumped into the dam in the past year. Dry filling has continued throughout the year, and at present the work consists in covering the hydraulic fill with dry material. The dam is 87 per cent completed. The principal part of the remaining work is the connection between the north end of the present work and the lock wall, over the space now occupied by the west storage trestle and crane tracks.

BACK FILLING.

Back filling the lock walls has been continued with material from the lock and prism excavation as follows:

TABLE NO. 13.—Back filling Miraflores lock walls.

Location.	Number of cubic yards of filling.			Per cent completed.
	This year.	Previous years.	Total.	
East wall.....	315,487	68,121	383,608	42
Center wall.....	7,912	.....	7,912	3
West wall.....	127,287	103,480	233,767	29
Total.....	450,686	174,601	625,287	32

DRY EXCAVATION IN PRISM.

The excavation by steam shovels in the channel between Pedro Miguel and Miraflores and south of the latter was continued. The details are given in the following table:

TABLE NO. 14.--*Excavation in canal prism.*

Month.	Material excavated (cubic yards).		
	Earth.	Rock.	Total.
1911.			
July.....	43,799	.....	43,799
August.....	4,311	49,853	54,164
September.....	9,924	27,173	37,097
October.....	5,070	18,020	23,090
November.....	11,471	7,707	19,178
December.....	9,700	26,340	36,040
1912.			
January.....	10,902	37,504	48,406
February.....	29,375	41,271	70,646
March.....	64,299	54,651	118,950
April.....	62,838	89,916	152,754
May.....	74,610	65,553	140,163
June.....	85,688	34,500	120,188
Total.....	411,987	452,488	864,475

Out of a total of 1,792,286 cubic yards excavated in the first district, 107,753 cubic yards were removed by hand and 1,684,533 cubic yards by steam shovels. The following two tables give in detail the performance of steam shovels:

TABLE NO. 15.—*Performance of steam shovels at Pedro Miguel.*

Month.	Average number of shovels working.	Hours under steam.	Hours working.	Material loaded per month (cubic yards).				Rainfall (inches).
				Earth.	Rock.	Total.	Average per hour under steam.	
1911.								
July.....	1.44	296	77.78	10,503	5,228	15,731	53.15	6.36
August.....	1.63	336	78.67	25,531	.....	25,531	75.98	5.43
September.....	1.32	284	81.25	.....	9,399	9,399	33.09	8.31
October.....	1.07	224	56.50	4,330	4,830	9,160	40.89	12.92
November.....	1.13	224	68.33	5,161	5,129	10,290	45.94	7.49
December.....	1.92	384	115.83	10,000	3,498	13,498	35.15	1.82
1912.								
January.....	1.92	400	125.67	21,540	.....	21,540	53.85	.00
February.....	2.29	440	126.67	38,990	.....	38,990	88.61	.22
March.....	2.42	504	169.58	43,103	.....	43,103	85.52	.02
April.....	3.12	624	229.83	75,479	.....	75,479	120.96	4.23
May.....	3.42	712	225.17	72,145	.....	72,145	101.33	6.32
June.....	3.24	648	179.08	36,627	.....	36,627	56.53	9.69
Total.....	2.08	5,076	1,534.36	343,409	28,084	371,493	73.18	62.81

TABLE NO. 16.—*Performance of steam shovels at Miraflores.*

Month.	Average number of shovels working.	Hours under steam.	Hours working.	Material loaded per month (cubic yards).				Rainfall (inches).
				Earth.	Rock.	Total.	Average per hour under steam.	
1911.								
July.....	6.64	1,804	430.42	128,760	.....	128,760	71.37	6.83
August.....	8.30	2,264	520.08	4,311	123,631	127,942	56.51	7.06
September.....	7.60	2,080	450.67	19,024	102,209	121,233	58.28	8.30
October.....	7.39	2,296	469.00	5,740	114,710	120,450	52.46	9.71
November.....	7.80	2,172	418.58	17,582	79,558	97,140	44.71	9.24
December.....	7.72	2,048	434.17	13,589	94,174	107,763	52.61	1.40
1912.								
January.....	5.81	1,696	398.67	10,532	123,374	133,906	78.95	.00
February.....	6.00	1,560	371.58	10,787	75,477	86,264	55.29	.34
March.....	6.23	1,792	401.92	22,116	71,203	93,319	52.08	.00
April.....	6.40	1,812	390.58	7,009	103,544	110,553	61.23	4.79
May.....	5.69	1,764	387.50	26,898	70,107	97,005	54.99	7.60
June.....	6.20	1,804	467.92	54,205	34,500	88,705	49.17	7.51
Total.....	6.81	23,092	5,141.09	320,553	992,487	1,313,040	56.86	62.78

MINING.

The following mining work was performed in connection with the excavation in the first district:

Item.	Unit.	Pedro Miguel.	Miraflores.	Total.
Drilling with power drills.....	Linear feet....	107,365	668,425	775,790
Drilling with hand drills.....	do.....			
Average number of feet drilled per cubic yard of material excavated.	do.....	.27	.48	.43
Explosives used.....	Gross tons.....	8.23	159.10	167.33
Average number of pounds of dynamite used per cubic yard of material excavated.	Pounds.....	.05	.26	.21

ELECTRICAL DEPARTMENT.

[H. K. Smith, electrical superintendent.]

The electrical department is charged with the operation and maintenance of all electrical equipment on the Pacific division, which includes the Miraflores power plant; Miraflores and Balboa substations; the various crane, pump, and crusher motors, aggregating a total horsepower of approximately 7,000; approximately 10 miles of pole transmission lines; and a division telephone system of 75 telephones.

SECOND DISTRICT.

DREDGING, BALBOA SHOPS, AND SHIPWAYS.

[W. G. Comber, resident engineer.]

DREDGING.

The following dredges were operated during the year :

TABLE No. 17.—*Pacific division dredges.*

Name.	Type.	Remarks.
Culebra.....	Suction dredge (seagoing).....	Out of commission 39 days for repairs.
Cardenas.....	5-yard dipper dredge.....	Out of commission 38 days for repairs.
Gopher.....	French ladder dredge (marine).....	Out of commission 13 days for repairs.
Badger.....	French ladder dredge.....	Out of commission 19 days for repairs.
Mole.....	French ladder dredge (marine).....	Out of commission 46 days for repairs.
Marmot.....	French ladder dredge.....	Out of commission 13 days for repairs.
Corozal.....	Ladder dredge.....	Out of commission 52 days for repairs.

DREDGE "COROZAL."

The *Corozal* is a self-propelling center ladder dredge recently purchased from Messrs. William Simons & Co., Renfrew, Scotland, and was delivered at Balboa by the contractor on March 27, 1912. The hull is built of steel and has a length over all of 268 feet 9 inches, a length at load water line of 239 feet, and a molded breadth of 45 feet. The draft light is 14 feet 4 inches, and 17 feet 4 inches when loaded with 1,200 tons of spoil and 100 tons of coal.

The dredge is designed to excavate mud or sand at the rate of 1,200 cubic yards per hour from a depth of 50 feet, and to discharge the spoil direct into hoppers of 1,020 cubic yards capacity or into barges alongside. Two sets of 39 buckets are provided; one set with a capacity of 54 cubic feet per bucket is to be used in soft material, the other set with a capacity of 34 cubic feet per bucket is intended for digging rock. The speed of dredging is between 18 and 14 buckets per minute.

The boiler plant consists of two cylindrical multi-tubular boilers, with a heating surface of 2,022 square feet each, and a grate area of 66 square feet each, supplying steam at a pressure of 180 pounds per square inch to two triple-expansion engines with cylinders 17, 27, and 43 inches in diameter and a stroke of 27 inches. Each engine develops about 930 horsepower, and by the use of proper clutches can be made to propel the vessel or to operate the dredging mechanism. The arrangement of gears allows three different speeds when dredging. There are two condensers with a cooling surface of 1,565 square feet each, two air pumps, two centrifugal circulating pumps, and two feed pumps. The dredge is provided with winches for maneuvering, and for raising and letting go anchors. There are two independent engines direct-connected to dynamos for generating electricity for lighting the ship above and below. The dredge is fitted with its own refrigerating plant. Exhaust steam from all auxiliary engines can be taken to either condenser in the engine room.

A bridge with navigating house is provided near the middle of the vessel, which contains a combined hand and steam steering gear, a binnacle compass, and repeating telegraph to the engine room. The navigating house is also provided with a repeating telegraph to the ladder hoisting winch and to the forward and after winches.

The two propellers are of cast iron, 9 feet 3 inches in diameter, with 12 feet pitch. When fully loaded the dredge is capable of steaming at the rate of 10 knots an hour, and covered the distance from the builders' yard to Balboa, 12,064 miles, in 96 days' actual sailing time.

The *Corozal* started work in the canal on April 11, 1912.

MOVEMENT OF DREDGES.

The *Culebra* was engaged in deepening the channel between Stations 2110 and 2480, and in maintaining the channels to the shipways and Panama Railroad docks.

The *Cardenas* operated in the channel between Stations 2100 and 2270, removing both earth and rock; it was also employed in maintaining the berths at the sand dock, and in excavating a channel to Flamenco Island.

The *Gopher* was engaged throughout the year in procuring sand for concrete work.

The *Badger* was employed in deepening the channel from Stations 2131 to 2151, which includes a rock shoal, and in dredging a portion of the terminal basin at Balboa.

The *Mole* dredged during the greater portion of the year on rock shoals between Stations 2186 and 2229, removing rock broken by the rock-breaking plant.

The *Marmot* worked between Stations 2125 and 2236, dredging both earth and rock. It also maintained the Union Oil Co.'s berth.

The *Corozal* was put in commission on April 11, and has been dredging rock and hard clay from the channel between Stations 2206 and 2215.

The monthly output of all dredges, except the *Gopher*, was as follows:

TABLE No. 18.—*Dredging output, Pacific division.*

[Cubic yards.]

Month.	Culebra.	Cardenas.	Badger.	Mole.	Marmot.	Corozal.	Total.
1911.							
July.....	213, 448	83, 547	89, 769	21, 700	124, 193	.....	532, 657
August.....	213, 261	49, 454	101, 426	13, 050	111, 408	.....	488, 599
September.....	259, 755	32, 448	90, 315	12, 050	90, 971	.....	485, 539
October.....	209, 244	23, 572	41, 341	19, 950	11, 758	.....	305, 865
November.....	211, 428	38, 544	116, 194	7, 350	40, 102	.....	413, 618
December.....	10, 498	32, 150	137, 771	14, 650	26, 111	.....	221, 180
1912.							
January.....	198, 641	31, 912	93, 553	17, 400	23, 062	.....	364, 568
February.....	252, 143	27, 246	47, 590	18, 596	26, 306	.....	371, 881
March.....	267, 542	27, 312	87, 116	17, 801	14, 252	.....	414, 023
April.....	230, 878	21, 851	109, 530	17, 860	17, 488	14, 841	412, 448
May.....	160, 251	11, 850	59, 308	.....	15, 858	115, 061	362, 328
June.....	187, 208	19, 250	51, 866	14, 415	14, 733	23, 724	311, 196
Total.....	2, 414, 297	399, 136	1, 025, 779	174, 822	516, 242	153, 626	4, 683, 902

NOTE.—The total Pacific division dredging output was distributed as follows: Dredging inside of canal prism, 3,884,287 cubic yards; dredging outside of canal prism, 799,615 cubic yards; total, 4,683,902 cubic yards.

At the close of the fiscal year the estimated amount of material to be dredged from the channel south of the Miraflores locks, including an estimate for siltage, is 4,194,059 cubic yards.

ROCK EXCAVATION.

South of Station 2142 the rock found in the canal section lies in separate shoals of relatively small area and volume, and is being removed by subaqueous methods. The table following shows the location and extent of the shoals that have been developed as the work progressed, and the amount of rock removed during the year:

TABLE NO. 19.—*Subaqueous rock excavation.*

Month.	Station location (method of breaking).		Area broken (square feet).	Volume excavated (cubic yards).
	Teredo.	Vulcan.		
1911.				
July.....	2190.....	2180.....	92,916	5,675
August.....	2190, 2195.....	2180, 2230.....	86,684	13,425
September.....	2195, 2200.....	2200.....	81,396	21,187
October.....	2170, 2175, 2195.....	2150, 2225, 2230.....	48,990	26,709
November.....	2175.....	2150.....	69,930	33,975
December.....	2175, 2150.....	2180.....	62,929	48,030
1912.				
January.....	2175.....	2180.....	72,019	35,745
February.....	2175, 2180, 2200.....	2180.....	60,226	51,922
March.....	2200, 2270.....	2180, 2150.....	68,789	38,436
April.....	2270.....	2150.....	64,360	24,824
May.....	2270.....	2150, 2225.....	46,845	78,501
June.....	2270.....	2225, 2250.....	44,525	31,787
Total.....			799,609	410,216

Two methods were employed to break the rock for dredging, viz, drilling under water with a drill scow, and breaking below water with a Lobnitz rock breaker; the former method requires the use of explosives.

OPERATION OF DRILL BARGE.

The drill barge *Teredo* operated throughout the year except when laid up for minor repairs. Three drills have been operated on two 10-hour shifts, and the performance is shown in the table following:

TABLE NO. 20.—*Performance of drill barge Teredo.*

Month.	Drilling.			Blasting.		Dredging.	
	Linear feet.	Hours worked.	Feet per hour.	Number of holes blasted.	Dynamite used (pounds).	Area covered (square feet).	Cubic yards. ¹
1911.							
July.....	23,589	1,090	21.64	1,339	42,217	36,120	26,585
August.....	20,610	1,132	18.20	1,358	41,464	40,412	31,707
September.....	13,717	1,002	13.69	934	31,260	21,020	12,951
October.....	12,744	1,122	11.36	638	39,259	15,950	11,815
November.....	9,051	1,100	8.23	420	21,325	10,500	8,347
December.....	9,843	1,159	8.49	521	19,920	13,025	9,116
1912.							
January.....	11,064	1,204	9.19	687	24,950	16,905	10,739
February.....	14,031	1,096	12.80	971	34,380	24,210	13,005
March.....	10,844	755	14.36	631	26,800	15,765	10,028
April.....	9,175	1,216	7.55	456	27,720	11,400	8,496
May.....	10,372	1,190	8.71	596	29,510	14,900	9,625
June.....	8,779	1,141	7.69	465	24,850	12,875	8,489
Total.....	153,819	13,207	11.64	9,016	363,655	236,082	160,903

¹ Figures show theoretical cubic yards broken and subsequently dredged when convenient.

OPERATION OF LOBNITZ ROCK BREAKER.

The rock breaker *Vulcan*, described in the annual report for 1910, was in commission during the entire year excepting delays for minor repairs. It has been operated on one 10-hour shift to avoid changing rams, which would be necessary on account of the range of tides for two shifts.

TABLE No. 21.—Performance of rock breaker *Vulcan*.

Month.	Rock breaker.						Dredges.	
	Number of holes.	Number of blows.	Total penetration (feet).	Blows per hole.	Penetration per blow (feet).	Penetration per hole (feet).	Area covered (square feet).	Cubic yards dredged. ¹
1911.								
July.....	3,494	16,124	11,919	4.61	0.74	3.41	56,796	6,945
August.....	2,859	11,885	10,452	4.16	.88	3.66	46,272	6,313
September.....	3,586	14,261	12,367	3.98	.87	3.45	57,376	7,335
October.....	2,065	10,260	6,737	4.97	.66	3.26	33,040	3,997
November.....	3,802	15,906	14,126	4.18	.89	3.72	59,430	8,355
December.....	3,119	15,405	16,278	4.94	1.06	5.22	49,904	9,653
1912.								
January.....	3,454	13,278	11,516	3.84	.87	3.33	55,114	6,668
February.....	2,251	9,898	8,100	4.39	.82	3.59	36,016	4,806
March.....	3,314	17,769	13,076	5.36	.74	3.95	53,024	7,546
April.....	3,310	17,983	13,021	5.43	.72	3.93	52,960	7,724
May.....	2,899	16,146	9,848	5.57	.61	3.40	31,945	4,032
June.....	2,645	13,374	8,503	5.05	.64	3.21	31,740	3,777
Total.....	36,798	172,289	135,943	4.68	.79	3.69	563,617	77,156

¹ Figures show theoretical cubic yards broken and subsequently dredged when convenient.

SAND FOR CONCRETE.

Sand for the lock masonry and other concrete construction is obtained from Chame Bay, located about 20 miles up the coast from Balboa. It is dredged with the ladder dredge *Gopher*, loaded into barges of 500 cubic yards capacity, towed to Balboa, and transferred to bins by rapid unloading cranes; from the bins it is loaded by gravity into cars and transported to the storage piles at the lock sites or to such other points as desired.

TABLE No. 22.—Sand produced, performance of dredge *Gopher*.

Month.	Cubic yards of sand produced.			
	Placed in storage.	Atlantic division.	Other departments, etc.	Total production.
1911				
July.....	32,179	146	1,589	33,914
August.....	39,820	361	848	41,029
September.....	38,635	378	1,105	40,118
October.....	43,678	946	910	45,534
November.....	33,737	751	1,315	35,803
December.....	40,177	1,092	932	42,201
1912				
January.....	35,966	11,484	2,837	50,287
February.....	36,667	9,438	2,284	48,389
March.....	39,835	9,090	2,213	51,138
April.....	48,388	230	2,627	51,245
May.....	63,265	188	2,188	65,641
June.....	57,240	290	2,008	59,538
Total.....	509,587	34,394	20,856	564,837

BALBOA SHOPS AND SHIPWAYS.

All necessary running repairs have been made to the plant and floating equipment. No new equipment was assembled or erected during the year.

RENEWALS AND REPAIRS.

Dredge Culebra: In addition to running repairs, the hull was cleaned and painted; the bilge pipe line, propellers, and suction pipes were renewed; a sand-excluding device was installed on the starboard propeller shaft, and the machinery given a general overhauling.

LADDER DREDGES.

Marmot: Cleaned and painted hull; put in new cesspool wheel and overhauled tumbler wheel, winch engines, and boiler. *Badger:* Cleaned and painted hull; repaired bucket ladder and chute; installed new shaft, bedplates for tumblers, new line of manganese steel buckets and bucket rollers. *Gopher:* Cleaned and painted hull; repaired hull, bucket ladder, and chute; installed new bucket rollers. *Mole:* Cemented hull; forged new anchor stock; repaired injector pipe and overhauled winches and deck. *Corozal:* Cleaned and painted hull; altered copper piping; fitted fender guards for chute ratchet wheel; repaired top shaft and installed fore-and-aft winches for heaving scows.

MISCELLANEOUS.

All tugs, scows, barges, and small boats were kept in good order, and numerous repairs were made for the Panama Railroad Co., commercial vessels entering the port of Balboa, and for other departments and divisions.

WHARF CONSTRUCTION.

The reenforced concrete dock constructed for the Panama Railroad Co. and described in the last annual report was completed during the year, including the back filling. The dredging in front of the wharf is not yet completed, but has progressed sufficiently to admit docking vessels for a length of 575 feet.

TABLE NO. 23.—Progress in sinking caissons, Panama Railroad dock.

Caisson No.	Date of starting.	Date at rock.	Elevation of rock.	Rate of progress.		
				Penetration (Feet).	Hours at work.	Penetration per hour.
	1911	1911				
22-B.....	Mar. 25	July 21	— 62.00	2.08	41	0.051
24-D.....	Apr. 11	Aug. 2	— 61.42	4.58	85	.054
24-C.....	Apr. 21	Dec. 4	— 60.00	12.50	263	.048
22-A.....	May 12	July 7	— 61.17	.08	5	.016
23-A.....	May 23	Nov. 11	— 58.00	11.00	111	.099
23-B.....	May 26	Aug. 10	— 61.17	6.25	116	.054
19-A.....	June 7	Sept. 30	— 59.75	25.58	222	.115
24-B.....	June 2	Dec. 6	— 59.42	15.00	201	.075
24-A.....	June 3	Dec. 4	— 59.00	12.17	178	.068
12-A.....	June 12	July 20	— 62.17	32.17	120	.268
11-A.....	June 13	July 15	— 61.75	17.00	79	.215
11-B.....	June 15	Aug. 10	— 60.17	42.84	178	.240
10-B.....	June 17	July 27	— 60.50	27.08	157	.172

TABLE No. 23.—*Progress in sinking caissons, Panama Railroad dock—Continued.*

Caisson No.	Date of starting.	Date at rock.	Elevation of rock.	Rate of progress.		
				Penetration (Feet).	Hours at work.	Penetration per hour.
	1911	1911				
9-B.....	June 21	July 29	— 52.00	41.83	155	0.270
12-B.....	June 29	Aug. 17	— 59.58	57.41	355	.162
4-A.....	July 6	July 26	— 56.00	56.67	207	.274
10-A.....	July 10	Aug. 5	— 62.83	59.33	272	.218
5-A.....	July 14	Aug. 4	— 57.00	54.50	237	.230
6-A.....	July 20	Sept. 8	— 63.33	59.33	440	.135
3-A.....	July 22	Aug. 12	— 54.50	54.67	283	.193
7-A.....	July 27	Aug. 28	— 59.50	54.00	309	.175
2-A.....	July 29	Sept. 27	— 57.67	57.58	354	.163
2-B.....	July 29	Aug. 26	— 57.67	55.84	308	.181
3-B.....	Aug. 1	Aug. 18	— 53.58	52.58	273	.193
2-C.....	Aug. 3	Aug. 25	— 54.00	52.75	264	.200
4-B.....	Aug. 7	Aug. 29	— 54.75	51.42	255	.201
8-B.....	Aug. 7	Oct. 5	— 60.92	58.92	510	.115
9-A.....	Aug. 10	Oct. 10	— 64.08	60.91	458	.133
5-B.....	Aug. 15	Sept. 30	— 55.67	52.67	325	.162
7-B.....	Aug. 15	Oct. 11	— 59.50	57.51	366	.157
6-B.....	Aug. 23	Nov. 4	— 59.25	56.25	422	.133
8-A.....	Aug. 25	Sept. 27	— 59.25	57.00	312	.183
13-B.....	Aug. 29	Oct. 5	— 62.08	66.58	321	.207
13-A.....	Aug. 30	Nov. 16	— 60.00	65.17	522	.125
14-A.....	Sept. 6	Dec. 10	— 60.00	66.00	473	.139
19-B.....	Sept. 8	Sept. 24	— 60.58	61.44	227	.270
18-A.....	Sept. 18	Oct. 20	— 59.83	62.84	401	.157
15-A.....	Sept. 20	Dec. 14	— 60.25	66.58	284	.234
18-B.....	Sept. 25	Oct. 26	— 60.83	65.59	376	.174
14-B.....	Oct. 2	Oct. 18	— 61.42	63.50	235	.270
17-A.....	Oct. 4	Nov. 2	— 59.17	61.50	390	.158
17-B.....	Oct. 6	Nov. 23	— 59.25	58.75	371	.158
16-A.....	Oct. 14	Oct. 31	— 61.08	65.33	238	.274
15-B.....	Oct. 31	Nov. 23	— 60.33	59.33	299	.198
16-B.....	Nov. 15	Dec. 23	— 60.00	60.17	424	.142

BALBOA TERMINALS.

SURVEYS AND BORINGS.

Preliminary surveys and borings were made to determine the location of the terminal docks, basin, coaling station and dry dock. Subsequent to the approval of the general plans for terminals 370,607 cubic yards have been dredged from the basin.

DRY EXCAVATION.

To provide space for the dry dock and terminal shops it will be necessary to excavate about 295,000 cubic yards from the northwest face of Sosa Hill. This work was begun with one steam shovel on June 12, and a second shovel will be cut in as soon as one is available. The excavated material is used for filling the sites of the shops and terminal yards; 23,140 cubic yards were removed prior to June 30, 1912.

MISCELLANEOUS.

CORUNDU RIVER DIVERSION.

In order that the tidal swamp between Ancon and Sosa Hills might be filled, it was necessary to divert the Corundu River through the site of the old Sosa-Corozal Dam. This was done by excavating a suitable channel with an orange-peel dredge.

THIRD DISTRICT.

MUNICIPAL AND SANITARY WORK.

[F. Cotton, assistant engineer.]

MUNICIPAL ENGINEERING.

This department operates and maintains certain permanent plants and makes all municipal improvements within the division, including the city of Panama. The permanent plants are the Ancon and Cocoli pumping and filtration stations and the Rio Grande and Cocoli reservoirs.

ANCON PUMPING AND FILTRATION STATION.

There were no changes made in this station, which is described in previous reports. It was maintained in good running order and the cost is shown in Table No. 24.

COCOLI PUMPING AND FILTRATION STATION.

This station was installed for the purpose of pumping sufficient water from the Cocoli reservoir to make up the deficiency in the Rio Grande supply, and was described in the last annual report. The constantly increasing consumption necessitated adding two pumps to the equipment during the past year. These supply the main through separate 10-inch pipes and are three-stage, motor-driven centrifugal pumps with a capacity of 1,500 gallons per minute each against a head of 300 feet. They are direct connected with 200-horsepower, three-phase, 25-cycle motors, and since they began operation the Cocoli reservoir has supplied 71 per cent of the total amount of water consumed. The cost of operation is given in Table No. 25.

RIO GRANDE AND COCOLI RESERVOIRS.

These reservoirs supply Culebra and all points south, including the city of Panama, with water for both domestic and construction purposes. The Cocoli supply enters the Rio Grande main at Miraflores. The consumption has steadily increased each year since the system was installed, as shown in Table No. 26.

TABLE No. 24.—Details of work and cost, Ancon pumping and filtration station.

Month.	Water pumped (gallons).	Cost of pumping.				Water filtered (gallons).	Cost of filtering.			
		Labor.	Material.	Total.	Per 1,000 gallons.		Labor.	Material.	Total.	Per 1,000 gallons.
1911.										
July.....	14,908,000	\$407.05	\$636.83	\$1,043.88	\$0.0700	60,047,512	\$50.01	\$9.76	\$59.77	\$0.0010
August.....	15,080,000	334.98	525.93	860.91	.0658	56,116,950	62.87	165.20	228.07	.0041
September....	12,287,000	316.76	493.77	810.53	.0660	51,777,795	78.42	4.93	83.35	.0016
October.....	13,508,000	350.83	619.96	970.79	.0719	55,944,000	49.81	61.34	111.15	.0020
November....	12,642,000	240.56	481.35	721.91	.0571	54,839,982	42.46	214.54	257.00	.0047
December....	13,534,000	251.70	527.93	779.63	.0576	60,862,292	63.39	179.61	243.00	.0040
1912.										
January.....	15,514,000	243.44	546.75	790.19	.0509	60,151,595	46.87	169.85	216.72	.0036
February....	13,305,000	286.29	544.07	830.36	.0624	54,415,592	41.23	163.28	204.51	.0038
March.....	10,590,000	212.82	584.68	797.50	.0753	54,639,897	39.29	174.42	213.71	.0039
April.....	11,497,000	248.23	585.66	833.89	.0725	52,337,667	59.73	160.70	220.43	.0042
May.....	13,978,000	281.87	686.37	968.24	.0693	56,193,177	45.49	116.11	161.60	.0029
June.....	14,119,000	159.82	483.27	643.09	.0455	53,392,222	41.27	472.33	513.60	.0096
Total...	158,962,000	3,334.35	6,716.57	10,050.92	.0632	670,718,681	621.09	1,891.97	2,513.06	.0037

TABLE No. 25.—*Details of work and cost, Cocoli pumping and filtration station.*

Month.	Water pumped (gallons).	Cost of pumping.				Water filtered (gallons).	Cost of filtering.			
		Labor.	Material.	Total.	Per 1,000 gal-lons.		Labor.	Material.	Total.	Per 1,000 gal-lons.
1911.										
July.....	40,282,000	\$394.49	\$1,650.59	\$2,045.08	\$0.0508	40,282,000	\$44.76	\$2.03	\$46.79	\$0.0012
August.....	39,712,000	545.13	2,665.55	3,210.68	.0808	39,712,000	47.83	2.57	50.40	.0013
September....	33,197,000	420.04	2,102.48	2,522.52	.0760	33,197,000	46.38	1.91	48.29	.0015
October.....	51,634,000	467.78	3,532.82	4,000.60	.0775	51,634,000	92.00	3.33	95.33	.0018
November.....	60,000,000	433.39	1,713.31	2,146.70	.0358	60,000,000	72.28	11.16	83.44	.0014
December.....	62,000,000	326.97	3,541.05	3,868.02	.0624	62,000,000	78.07	2.84	80.91	.0013
1912.										
January.....	60,000,000	269.01	3,474.06	3,743.07	.0624	60,000,000	77.98	6.35	84.33	.0014
February.....	58,000,000	317.06	2,924.36	3,241.42	.0559	58,000,000	83.22	.91	84.13	.0015
March.....	62,000,000	527.02	3,548.30	4,075.32	.0657	22,000,000	34.94	.39	35.33	.0016
April.....	97,500,000	1,102.94	3,528.95	4,631.89	.0475					
May.....	133,920,000	587.07	4,904.24	5,491.31	.0410					
June.....	172,800,000	426.71	4,360.13	4,786.84	.0277					
Total....	871,045,000	5,817.61	37,945.84	43,763.45	.0502	426,825,000	577.46	31.49	608.95	.0014

The Cocoli filters were disconnected from the pumps during the month of March on account of the fact that the amount of water passing through the filters exceeded their capacity, thereby furnishing water that was not superior to the raw water and at the same time reducing the efficiency of the pumps.

TABLE No. 26.—*Water consumption from Culebra (included) south.*

	Reservoirs.		Total (gallons).
	Rio Grande (gallons).	Cocoli (gallons).	
Fiscal year—			
1905 ¹	No record.	.....	.....
1906 ¹	No record.	.....	.....
1907 ²	No record.	.....	.....
1908.....	942,200,000	.....	942,200,000
1909.....	1,104,421,000	.....	1,104,421,000
1910.....	1,259,771,000	38,179,000	1,297,950,000
1911.....	1,410,057,000	327,733,000	1,737,790,000
1912.....	1,184,681,370	871,045,000	2,055,726,370

¹ Water first turned into main to Ancon on June 26, 1905; and into Panama on July 4, 1905.

² Venturi meter installed January, 1907. No record of water consumption between date of installation of meter and July 1, 1907.

RIO GRANDE RESERVOIR.

The Rio Grande is a permanent reservoir and has been maintained at a total cost of \$5,844.45 for the year, and furnished 1,184,681,370 gallons of water.

COCOLI RESERVOIR.

The Cocoli reservoir is formed by the west dam at Miraflores, and is supplied by the Cocoli River; it will ultimately be a portion of Miraflores Lake, and is to be used as a reservoir during the construction period only. The cost of maintaining this reservoir has been \$514.23, and it has supplied 871,045,000 gallons of water during the year.

Following is general information pertaining to the reservoirs:

TABLE No. 27.—*Pacific division reservoirs.*

Detail.	Unit.	Rio Grande.	Cocoli.	Total.
Drainage area.....	Square miles.....	3.15	17.00	20.15
Maximum lake area.....	Acres.....	72.77	129.51	202.28
Elevation of spillway with flashboards.....	Feet.....	238.17	43.00	.....
Maximum depth of water.....	do.....	52.67	33.00	.....
Total capacity.....	Gallons.....	490,667,000	798,700,000	1,289,367,000
Storage at lowest elevation, 1911-1912.....	do.....	74,850,000	373,235,000	448,085,000
Average daily consumption:				
1911-1912.....	do.....	3,236,834	2,379,905	5,616,739
City of Panama.....	do.....	.....	.....	1,398,242

The total amount of water consumed in the past year was 2,055,-726,370 gallons, including 511,756,681 gallons used in the city of Panama. A detailed statement of the consumption by districts is given in Table No. 28.

TABLE No. 28.—*Consumption of water by districts, 1911-12.*

[Gallons.]				
Month.	Panama.	Ancon high service.	Balboa (6-inch and 10-inch mains).	Cucaracha pump.
1911.				
July.....	45,139,512	14,908,000	10,402,500	14,325,740
August.....	43,036,950	13,080,000	19,438,700	13,101,480
September.....	39,490,795	12,287,000	18,721,600	13,503,640
October.....	42,436,000	13,508,000	18,363,500	14,372,600
November.....	42,197,982	12,642,000	17,119,200	12,987,410
December.....	47,328,292	13,534,000	16,185,800	12,424,930
1912.				
January.....	44,637,595	15,514,000	15,649,000	12,092,470
February.....	41,110,592	13,305,000	14,581,300	10,584,720
March.....	44,049,897	10,590,000	18,412,400	8,514,530
April.....	40,840,667	11,497,000	18,151,600	11,538,850
May.....	42,215,177	13,978,000	19,731,100	13,234,500
June.....	39,273,222	14,119,000	18,214,200	14,803,300
Total.....	511,756,681	158,962,000	204,970,900	151,484,170
Month.	Pedro Miguel, Paraiso, Cucaracha, Miraflores, Corozal, and Ancon low service.	Source of supply.		
		Rio Grande reservoir.	Cocoli reservoir.	Total.
1911.				
July.....	65,034,988	109,528,740	40,282,000	149,810,740
August.....	62,929,350	111,874,480	39,712,000	151,586,480
September.....	60,082,605	110,888,640	33,197,000	144,085,640
October.....	72,942,500	109,988,600	51,634,000	161,622,600
November.....	83,252,818	108,199,410	60,000,000	168,199,410
December.....	84,263,908	111,736,930	62,000,000	173,736,930
1912.				
January.....	84,697,405	112,590,470	60,000,000	172,590,470
February.....	85,255,488	106,837,100	58,000,000	164,837,100
March.....	96,090,173	115,657,000	62,000,000	177,657,000
April.....	91,870,883	76,399,000	97,500,000	173,899,000
May.....	98,553,223	53,792,000	133,920,000	187,712,000
June.....	143,579,278	57,189,000	172,800,000	229,989,000
Total.....	1,028,552,619	1,184,681,370	871,045,000	2,055,726,370

NOTE.—The consumption given for Pedro Miguel, Paraiso, Cucaracha, Miraflores, Corozal, and Ancon low service is the difference between the total consumption of the various other districts (which are metered) and the total supply.

PANAMA IMPROVEMENTS.

The municipal and sanitary improvements in the city of Panama have been made by the commission, and the cost is repaid through the collection of water taxes, as provided in Article VII of the treaty between the United States and the Republic of Panama. The work performed in the past year comprises grading and macadamizing streets, placing concrete curbs and gutters and laying water and sewer lines in the portion of the city bounded by Fourth of July Avenue, B Street, West Sixteenth Street and the Zone Line Road, as shown on plate 94. The amount and cost of the work is shown in Table No. 29.

TABLE No. 29.—*New street improvements in the city of Panama, November, 1909, to June 30, 1912.*

Name of district and street.	Paving and curbing.		Sewer mains and laterals.				Water mains and laterals.				Total cost of streets.	Total cost of districts.			
	Street length (feet).	Street width (feet).	Cost.	Mains.		Laterals.		Cost.	Mains.				Laterals.		
				Linear feet.	Size (in.).	Linear feet.	Size (in.).		Linear feet.	Size (in.).			3-inch.		
Cocoa Grove:															
West Seventeenth Street...	840	18	\$1,244.27	}	600	{	139	6	368	4	139	\$523.33	\$1,875.93		
West Eighteenth Street...	1,760	18	2,284.67				270	6	584	4	330	864.65			
West Nineteenth Street...	1,553	18	2,160.22				192	6	485	4	240	807.26			
West Twentieth Street...	1,667	18	2,658.70	}	843	{	264	6	823	4	304	1,127.86	4,846.26		
Sur Avenue.....	428	16	615.65				48	6	232	4	54	282.83	1,129.68		
San Vicente Street.....	1,750	18	2,287.68				160	6	27	4	157	272.07	2,733.12		
Guachapali:													\$17,477.94		
Thirty-first Street.....	1,084	24	2,040.00	}	547	{	106	6	543	6	450	962.55	4,512.87		
Thirty-second Street.....	1,180	24	2,945.03				188	6	613	6	464	1,093.75	4,918.52		
Thirty-third Street.....	1,168	24	2,999.96				188	6	604	6	464	993.46	4,825.17		
Thirty-fourth Street.....	1,160	24	1,909.95	}	600	{	227	6	600	6	492	931.92	3,649.31		
Thirty-fifth Street.....	1,134	24	2,161.73				192	6	591	6	435	1,039.04	4,572.76		
Thirty-sixth Street.....	720	24	1,789.85				174	6	385	6	232	707.11	3,437.41		
Istmo Street.....	3,538	24	{	183	10	282	6	1,640	8	696	2,597.70	13,813.08			
		18		1,392	8										
		18		1,137	10	304	6	1,137	6	841	1,880.11	8,770.27			
Republica Street.....	1,941	24	4,553.62	}	100	{	144	6	578	6	377	916.39	3,849.01		
Ossa Street.....	1,181	24	2,090.49				176	6	591	6	419	954.93	4,181.90		
Escobar Street.....	1,173	24	2,406.60				120	6	377	6	348	596.30	2,224.51		
Concordia Street.....	739	24	1,187.84	}	347	{	132	6	440	6	362	673.97	2,827.45		
Herobar Street.....	816	24	1,642.58				430	10							1,143.98
Mueller Place.....	400	24	683.88						310	8		460.10			
Avenue B:													62,726.24		
East Twentieth Street.....	740	16	1,125.72	}	338	{	120	6	(1)	4	153	145.71	1,681.34		
East Twenty-first Street...	660	15	1,144.67				104	6			338.69	6	104	427.95	1,911.31
East Twenty-second Street...	550	16	1,171.16				104	6			352.54	6	132	359.71	1,883.41
East Twenty-third Street..	400	15	908.45	}	175	{	48	6	170	6	59	282.92	1,462.66		
Obarrio Place.....	920	18	1,796.26				184	6	580.04	6	224	607.23	2,983.63		
Lyons Street.....	1,018	18	1,586.87				152	6	515.97	6	213	622.66	2,725.50		

[illegible]

1 Changing line.

NOTE.—Expenditures, included in the above table, during the fiscal year 1911-12 amounted to \$39,605.01, of which amount \$859.96 was paid by the Republic of Panama upon completion of the work.

ZONE WATERWORKS.

The water mains were patrolled and maintained and all necessary house connections, standpipes, and fire hydrants installed. The uniform increase in consumption made it necessary to replace the 16-inch main from the Rio Grande reservoir with a 20-inch line. The 16-inch pipe, however, has been left in position from the reservoir to the Pedro Miguel locks, where both mains are connected to a 24-inch pipe which is embedded in the emergency dam sills; both mains are again connected on the east side of the locks, and the double line extends to within 2,490 feet of the Ancon pumping station. This was done not only to insure the supply and pressure at the south end of the system, but also to avoid changing a large number of temporary connections that have been made for construction work from the 16-inch to the 20-inch main. The changes made during the year also included laying a second 10-inch line from the Cocoli pumping station to the main at Miraflores.

The demand on this system is now largely in excess of the capacity provided when first installed, and it has been necessary, from time to time, to adopt the most available means to meet the emergency regardless of system or economy of operation.

A comprehensive study of the conditions that will prevail when the canal is completed is under way, with the idea of recommending a modification of the entire system.

TABLE No. 30.—*Cost of maintenance and repairs, Zone waterworks.*

Description.	Labor.	Material.	Total.
Balboa.....	\$963.32	¹ \$69.38	\$893.94
East Balboa.....	187.48	¹ 32.17	155.31
Ancon district.....	921.15	¹ 29.79	891.36
Corozal district.....	51.72	2.60	54.32
Miraflores district.....	264.65	10.09	274.74
Pedro Miguel district.....	2,246.89	¹ 11.34	2,235.55
Inspection of water pipes.....	586.13	16.44	602.56
Water analysis.....	475.19	² 36.78	511.97
Total.....	5,696.52	¹ 76.77	5,619.75

¹ Material credits.² Beginning April 1, 1912.

A detailed statement of the construction work performed during the year is given in Table No. 31.

ZONE SEWERAGE SYSTEM.

The work performed during the year consisted in making repairs, minor extensions, and house connections as detailed in Table No. 32.

ZONE ROADS.

Aside from minor extensions of streets in the various towns, there were no new roads built. Existing roads, including that to the Sabanas, were kept in repair.

TABLE NO. 31.—*Zone waterworks construction, statement of work performed during fiscal year 1911-12.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
BALBOA DISTRICT.					
Installing 2-inch pump for bachelor quarters:					
Excavation.....	2 cubic yards.....	\$2.11		\$2.11	\$1.06
Laying 2-inch pipe and making connections.	181 linear feet.....	28.38	\$21.39	49.77	.27
Total.....		30.49	21.39	51.88	
Connection for central division time office:					
Laying ¾-inch galvanized-iron pipe.....	70 linear feet.....	15.17	4.13	19.30	.28
Total.....		15.17	4.13	19.30	
Relocate 10-inch Balboa main:					
Excavation.....	173 cubic yards....	231.07		231.07	1.34
Backfill.....	64 cubic yards.....	25.13		25.13	.39
Laying 10-inch cast-iron pipe.....	636 linear feet.....	241.11	19.40	260.51	.41
Total.....		497.31	19.40	516.71	
Total, Balboa district.....		542.97	44.92	587.89	
ANCON DISTRICT.					
Laying 10-inch pipe line for high pressure:					
Excavation.....	18 cubic yards.....	24.75		24.75	1.38
Constructing valve boxes.....		51.13	7.40	58.53	
Handling material.....		61.38		61.38	
Laying pipe.....	74 linear feet.....	91.54	55.71	147.25	1.99
Backfill.....	154 cubic yards....	108.42		108.42	.70
Total.....		337.22	63.11	400.33	
Installing hydrant for schoolhouse:					
Excavation.....	6 cubic yards.....	5.73		5.73	.95
Laying 2½-inch pipe.....	41 linear feet.....	9.78	6.57	16.35	.40
Backfill.....	6 cubic yards.....	2.83		2.83	.47
Total.....		18.34	6.57	24.91	
Changing location of 8-inch check valve, Bishops Hollow:					
Excavation.....	3 cubic yards.....	3.81		3.81	1.27
Handling material.....		4.74		4.74	
Backfill.....	3 cubic yards.....	1.32		1.32	.44
Laying 8-inch pipe.....	14 linear feet.....	12.27	.54	12.81	.92
Total.....		22.14	.54	22.68	
Connection to Hotel Tivoli addition:					
Excavation.....	32 cubic yards.....	17.33		17.33	.54
Back fill.....	do.....	8.54		8.54	.27
Laying 6-inch pipe.....	150 linear feet.....	7.26	.89	8.15	.05
Total.....		33.13	.89	34.02	
Installing standpipe for fire protection, Hotel Tivoli:					
Excavation.....	44 cubic yards.....	39.80		39.80	.90
Back fill.....	do.....	15.50		15.50	.35
Laying 3-inch galvanized-iron pipe.....	317 linear feet.....	28.92	83.48	112.40	.35
Total.....		84.22	83.48	167.70	
Connection to Ancon Colored School:					
Excavation.....	8 cubic yards.....	3.10		3.10	.39
Back fill.....	do.....	2.05		2.05	.26
Laying 1-inch galvanized-iron pipe.....	500 linear feet.....	10.69	31.74	42.43	.08
Total.....		15.84	31.74	47.58	
Connection to Chinese Cemetery:					
Laying ¾-inch galvanized-iron pipe.....	50 linear feet.....	8.68	2.00	10.68	.21
Total.....		8.68	2.00	10.68	

TABLE No. 31.—Zone waterworks construction, statement of work performed during fiscal year 1911-12—Continued.

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
ANCON DISTRICT—continued.					
Lowering 2½-inch line in way of proposed tramway:					
Excavation.....	50 cubic yards.....	\$43.35	.....	\$43.35	\$0.84
Back fill.....	23 cubic yards.....	6.65	.....	6.65	.29
Altering pipe.....		2.64	\$1.10	3.74	.....
Total.....		52.64	1.10	53.74	.....
Connections to house moved from Balboa:					
Excavation.....	150 cubic yards.....	135.25	.....	135.25	.90
Back fill.....	85 cubic yards.....	41.18	.....	41.18	.48
Laying 1½-inch galvanized-iron pipe.....	611 linear feet.....	38.27	32.01	70.28	.12
Total.....		214.70	32.01	246.71	.....
Total, Ancon district.....		786.91	221.44	1,008.35	.....
COROZAL DISTRICT.					
Changing water line to houses Nos. 31 and 63: Laying 1½-inch pipe.	180 linear feet.....	14.09	18.50	32.59	.18
Connection for garden hose in front of Isthmian Canal Commission Hotel: Laying pipe and making connection.	126 linear feet.....	32.11	4.11	36.22	.29
Installing fire hydrant near Isthmian Canal Commission Hotel:					
Excavation.....	31 cubic yards.....	22.31	.....	22.31	.72
Backfill.....	31 cubic yards.....	12.14	.....	12.14	.39
Laying 3-inch galvanized-iron pipe and installing standpipe.	50 linear feet.....	12.14	20.64	32.78	.65
Total.....		46.59	20.64	67.23	.....
Connections to houses Nos. 79, 80 and 81:					
Excavation.....	5 cubic yards.....	4.25	.....	4.25	.85
Back fill.....	5 cubic yards.....	2.18	.....	2.18	.44
Laying 1-inch galvanized-iron pipe.....	245 linear feet.....	20.39	5.44	25.83	.06
Laying 1½-inch galvanized-iron pipe.....	218 linear feet.....				
Total.....		26.82	5.44	32.26	.....
Connections to houses Nos. 82 and 83:					
Excavation.....	3 cubic yards.....	2.34	.....	2.34	.78
Back fill.....	3 cubic yards.....	1.17	.....	1.17	.39
Laying ¾-inch galvanized-iron pipe.....	180 linear feet.....	3.80	4.13	7.93	.04
Total.....		7.31	4.13	11.44	.....
Total, Corozal District.....		126.92	52.82	179.74	.....
MIRAFLORES DISTRICT.					
Removal of Caimitillo pipe line: Disconnecting and reclaiming 10-inch pipe.	7,355 linear feet.....	600.15	21.84	621.99	.08
Moving 50,000-gallon tank near Cocoli shops:					
Handling material.....		62.69	.....	62.69	.....
Excavation.....	172 cubic yards.....	152.62	.....	152.62	.89
Back fill.....	195 cubic yards.....	104.10	.....	104.10	.53
Constructing scaffold.....		128.06	151.69	279.75	.....
Concrete piers.....	11 cubic yards.....	33.08	27.26	60.34	5.49
Laying 3-inch pipe.....	610 linear feet.....	88.03	168.31	256.34	.42
Moving tank.....		307.35	219.44	526.79	.....
Engineering.....		23.89	.....	23.89	.....
Total.....		899.82	566.70	1,466.52	.....
5-inch pipe line near yard office:					
Handling material.....		192.73	.....	192.73	.....
Excavation.....	12 cubic yards.....	15.78	.....	15.78	1.32
Laying 5-inch pipe.....	3,258 linear feet.....	327.19	1,103.47	1,430.66	.44
Total.....		535.70	1,103.47	1,639.17	.....
Moving standpipe at Corozal Junction: Laying 5-inch black iron pipe and making connection.	600 linear feet.....	80.86	193.77	274.63	.46

TABLE No. 31.—*Zone waterworks construction, statement of work performed during fiscal year 1911-12—Continued.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
MIRAFLORES DISTRICT—continued.					
Installing 10-inch line from Cocoli pumps to Rio Grande main:					
Excavation.....	347 cubic yards....	\$334.02	.....	\$334.02	\$0.96
Back fill.....	141 cubic yards....	70.25	.....	70.25	.50
Laying 10-inch pipe.....	4,439 linear feet....	932.22	\$190.97	1,123.19	.25
Total.....		1,336.49	190.97	1,527.46	.....
Connecting 16-inch Cocoli line to Miraflores locks water system:					
Excavation.....	32 cubic yards....	31.24	.....	31.24	.98
Laying 5-inch black iron pipe.....	779 linear feet....	197.59	108.37	305.96	.39
Total.....		228.83	108.37	337.20	.....
Installing 12-inch "Booster" pump in Rio Grande main:					
Excavation.....	40 cubic yards....	38.45	.....	38.45	.96
Installing pump.....		552.38	178.79	731.17	.....
Back fill.....	55 cubic yards....	25.30	.....	25.30	.46
Total.....		616.13	178.79	794.92	.....
Installing water tap for John Molloy: Making tap.		2.28	.63	2.91	.....
Relocation of water line to hydraulic pumps:					
Excavation.....	102 cubic yards....	105.23	.....	105.23	1.03
Laying 2½-inch pipe.....	7,330 linear feet....	654.47	266.65	921.12	.13
Total.....		759.70	266.65	1,026.35	.....
Extension of 3-inch water line to cement shed: Laying 3-inch pipe.	120 linear feet....	12.82	13.30	26.12	.22
4-inch water line to planing mill:					
Excavation.....	23 cubic yards....	20.32	.....	20.32	.88
Laying 4-inch pipe.....	2,140 linear feet....	132.77	322.87	455.64	.21
Total.....		153.09	322.87	475.96	.....
Extension of 5-inch water line on west side Miraflores locks:					
Excavation.....	17 cubic yards....	15.20	.....	15.20	.89
Laying 5-inch pipe.....	1,180 linear feet....	110.95	473.05	584.00	.49
Taking up old 5-inch pipe.....	1,140 linear feet....	48.11	.....	48.11	.04
Total.....		174.26	473.05	647.31	.....
Laying 8-inch pipe to Riley's spur bridge:					
Excavation.....	54 cubic yards....	45.20	.....	45.20	.84
Back fill.....	35 cubic yards....	16.41	.....	16.41	.47
Laying 8-inch pipe.....	560 linear feet....	202.03	82.04	284.07	.51
Total.....		263.64	82.04	345.68	.....
Connecting Riley's spur standpipe to 8-inch line: Laying 4-inch black iron pipe.	400 linear feet....	53.64	61.41	115.05	.29
Installation of new Cocoli pumps: Installing two 10-inch centrifugal pumps in Cocoli pumping plant.		1,103.14	6,010.73	7,113.87	.....
Total, Miraflores district.....		6,820.55	9,594.59	16,415.14	.....
PEDRO MIGUEL DISTRICT.					
Water main across forebay of Pedro Miguel locks: Laying 24-inch pipe.	275 linear feet....	260.03	86.63	346.66	1.26
Relocation of 16-inch main:					
Excavation.....	14 cubic yards....	14.43	.....	14.43	1.03
Moving pipe.....		33.90	1.52	35.42	.....
Total.....		48.33	1.52	49.85	.....
Connecting Pedro Miguel engine-house pump with main: Making connection.		47.30	18.48	65.78	.....
Water tap for George Athanasiadis: Installing tap.		1.46	.61	2.07	.....

TABLE No. 31.—*Zone waterworks construction, statement of work performed during fiscal year 1911-12—Continued.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
PEDRO MIGUEL DISTRICT—continued.					
Installation of water crane at Pedro Miguel engine house:					
Excavation	8 cubic yards.....	\$7.75	.....	\$7.75	\$0.97
Backfill.....	27 cubic yards.....	13.40	.....	13.40	.50
Installing crane.....	.....	69.23	\$136.13	205.36	.....
Total.....	.....	90.38	136.13	226.51	.....
Pipe line to Pedro Miguel engine house: Laying 2-inch pipe.	385 linear feet.....	20.39	.....	20.39	.05
Installing tap for Pedro Miguel native village: Laying $\frac{3}{4}$ -inch galvanized-iron pipe.	80 linear feet.....	4.55	2.51	7.06	.09
Connection to house No. 57:					
Excavation.....	4 cubic yards.....	4.10	.....	4.10	1.03
Backfill.....	do.....	1.20	.....	1.20	.30
Laying $\frac{3}{4}$ -inch galvanized-iron pipe.....	29 linear feet.....	5.15	.13	5.28	.18
Total.....	.....	10.45	.13	10.58	.....
Connection to watch inspector's office: Making 1-inch tap in 20-inch main.					
.....	.....	7.00	.58	7.58	.....
Total, Pedro Miguel district.....	.....	489.89	246.59	736.48	.....
20-INCH WATER MAIN FROM RIO GRANDE RESERVOIR TO PANAMA, AND CONNECTIONS.					
Installation of 20-inch water main:					
Unloading pipe.....	.....	2,588.28	.....	2,588.28	.....
Cutting broken ends.....	.....	206.10	.....	206.10	.....
Lowering culverts.....	.....	81.62	.....	81.62	.....
Excavation.....	20,753 cubic yards.....	19,006.04	.....	19,006.04	.92
Handling and laying 20-inch pipe and installing fittings.	47,648 linear feet.....	13,875.71	102,917.64	116,793.35	2.45
Making joints.....	.....	3,091.61	6,021.19	9,112.80	.....
Back fill.....	10,978 cubic yards.....	8,169.96	.....	8,169.96	.74
Total.....	.....	47,019.32	108,938.83	155,958.15	.....
6-inch connections:					
Excavation.....	271 cubic yards.....	287.24	.....	287.24	1.06
Laying pipe.....	1,522 linear feet.....	192.71	863.49	1,056.20	.69
Back fill.....	271 cubic yards.....	128.29	.....	128.29	.47
Total.....	.....	608.24	863.49	1,471.73	.....
4-inch connections:					
Excavation.....	230 cubic yards.....	175.19	.....	175.19	.76
Laying pipe.....	1,454 linear feet.....	151.79	407.47	559.26	.38
Back fill.....	54 cubic yards.....	23.92	.....	23.92	.44
Total.....	.....	350.90	407.47	758.37	.....
3½-inch connections:					
Excavation.....	12 cubic yards.....	10.05	.....	10.05	.84
Laying pipe.....	210 linear feet.....	17.41	51.98	69.39	.33
Back fill.....	12 cubic yards.....	4.20	.....	4.20	.35
Total.....	.....	31.66	51.98	83.64	.....
3-inch connections:					
Excavation.....	14 cubic yards.....	18.71	.....	18.71	1.34
Laying pipe.....	504 linear feet.....	28.99	135.89	164.88	.33
Back fill.....	14 cubic yards.....	10.36	.....	10.36	.74
Total.....	.....	58.06	135.89	193.95	.....
2½-inch connections:					
Excavation.....	8 cubic yards.....	10.02	.....	10.02	1.25
Laying pipe.....	172 linear feet.....	6.82	28.44	35.26	.21
Back fill.....	8 cubic yards.....	3.99	.....	3.99	.50
Total.....	.....	20.83	28.44	49.27	.....
1-inch connections: Laying pipe.....	800 linear feet.....	20.10	27.66	47.76	.06
Total, 20-inch main and connections.....	.....	48,109.11	110,453.76	158,562.87	.....

TABLE NO. 31.—*Zone waterworks construction, statement of work performed during fiscal year 1911-12—Continued.*

RECAPITULATION.

	Labor.	Material.	Total.
Balboa district.....	\$542.97	\$44.92	\$587.89
Ancon district.....	786.91	221.44	1,008.35
Corozal district.....	126.92	52.82	179.74
Miraflores district.....	6,820.55	9,594.59	16,415.14
Pedro Miguel district.....	489.89	246.59	736.48
20-inch main and connections.....	48,109.11	110,453.76	158,562.87
Grand total.....	56,876.35	120,614.12	177,490.47

TABLE NO. 32.—*Statement of work performed on sewers during fiscal year ended June 30, 1912.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
BALBOA DISTRICT.					
Connection to central division time office: Laying 6-inch vitrified pipe.	27 linear feet 6-inch vitrified pipe.	\$8.05	\$2.74	\$10.79	\$0.40
ANCON DISTRICT.					
Connections to new houses moved from Balboa:					
Excavation.....	358 cubic yards.....	315.45		315.45	.88
Backfill.....	226 cubic yards.....	89.71		89.71	.40
Laying 1½-inch galvanized-iron pipe..	1,040 linear feet 1½-inch pipe.	151.05	35.20	186.25	.18
Total.....		556.21	35.20	591.41	
Sewer from West Indian camp to 16-inch drain:					
Excavation.....	404 cubic yards.....	241.82		241.82	.60
Laying 8-inch pipe.....	228 linear feet 8-inch vitrified pipe.	41.64	15.20	56.84	.25
Total.....		283.46	15.20	298.66	
Total, Ancon district.....		839.67	50.40	890.07	
COROZAL DISTRICT.					
Connection to house No. 84:					
Excavation.....	21 cubic yards.....	21.75		21.75	1.03
Back fill.....	22 cubic yards.....	10.75		10.75	.49
Laying 6-inch pipe.....	312 linear feet 6-inch vitrified pipe.	46.29	.67	46.96	.15
Total.....		78.79	.67	79.46	
Extend sewer near incinerator:					
Excavation.....	93 cubic yards.....	91.16		91.16	.98
Back fill.....	60 cubic yards.....	19.94		19.94	.33
Handling material.....		18.45		18.45	
Laying 6-inch pipe.....	700 linear feet 6-inch vitrified pipe.	31.81	111.34	143.15	.20
Manhole.....		11.36	9.30	20.66	
Total.....		172.72	120.64	293.36	
Connections to houses Nos. 79, 80, and 81:					
Excavation.....	2 cubic yards.....	1.75		1.75	.88
Back fill.....	do.....	.95		.95	.48
Laying 6-inch pipe.....	42 linear feet 6-inch vitrified pipe.	6.43	1.85	8.28	.20
Total.....		9.13	1.85	10.98	

TABLE No. 32.—*Statement of work performed on sewers during fiscal year ended June 30, 1912—Continued.*

Description.	Quantities of work performed.	Labor.	Material.	Total.	Unit cost.
COROZAL DISTRICT—continued.					
Connections to houses Nos. 82 and 83:					
Excavation.....	6 cubic yards.....	\$4.77	.....	\$4.77	\$0.79
Back fill.....	do.....	2.38	.....	2.38	.39
Laying 6-inch pipe.....	216 linear feet 6-inch vitrified pipe.	6.26	\$2.76	9.02	.04
Total.....		13.41	2.76	16.17	.....
Connection to Y. M. C. A.:					
Excavation.....	9 cubic yards.....	6.13	.....	6.13	.68
Back fill.....	do.....	2.89	.....	2.89	.32
Laying 6-inch pipe.....	40 linear feet 6-inch vitrified pipe.	1.69	6.99	8.68	.22
Total.....		10.71	6.99	17.70	.....
Total, Corozal district.....		284.76	132.91	417.67	.....
MIRAFLORES DISTRICT.					
Connection to colored school:					
Excavation.....	3 cubic yards.....	3.78	.....	3.78	1.26
Laying 6-inch pipe.....	75 linear feet 6-inch vitrified pipe.	14.59	10.24	24.83	.33
Total.....		18.37	10.24	28.61	.....
Total, Miraflores district.....		18.37	10.24	28.61	.....
PEDRO MIGUEL DISTRICT.					
Connection to house No. 57:					
Excavation.....	8 cubic yards.....	4.07	.....	4.07	.11
Back fill.....	do.....	2.38	.....	2.38	.50
Laying 6-inch pipe.....	80 linear feet 6-inch vitrified pipe.	8.40	.15	8.55	.31
Total.....		14.85	.15	15.00	.....
Connection to watch inspector's office:					
Excavation.....	21 cubic yards.....	22.50	.....	22.50	1.07
Back fill.....	12 cubic yards.....	5.32	.....	5.32	.44
Laying 6-inch vitrified pipe.....	90 linear feet.....	66.75	26.80	93.55	.53
Laying 6-inch wrought-iron pipe.....	85 linear feet.....				
Total.....		94.57	26.80	121.37	.....
Total, Pedro Miguel district.....		109.42	26.95	136.37	.....

RECAPITULATION.

Location.	Labor.	Material.	Total.
Balboa district.....	\$8.05	\$2.74	\$10.79
Ancon district.....	839.67	50.40	890.07
Corozal district.....	284.76	132.91	417.67
Miraflores district.....	18.37	10.24	28.61
Pedro Miguel district.....	109.42	26.95	136.37
Grand total.....	1,260.27	223.24	1,483.51
ZONE SEWER MAINTENANCE.			
Balboa district.....	144.88	11.99	156.87
Ancon district.....	443.57	18.13	461.70
Corozal district.....	19.19	9.87	29.06
Pedro Miguel district.....	530.31	49.08	579.39
Total.....	1,137.95	89.07	1,227.02

TABLE NO. 33.—*Maintenance and repairs, Canal Zone roadways.*

	Labor.	Material.	Total.
Balboa district.....	\$92.96	\$78.56	\$171.52
Ancon district.....	729.55	391.36	1,120.91
Sabanas Road.....	1,159.35	4,072.17	5,231.52
Corozal district.....	209.06	86.55	295.61
Corozal-Pedro Miguel Road.....	982.63	125.01	1,107.64
Miraflores district.....	506.61	161.84	671.45
Pedro Miguel district.....	381.96	247.35	629.31
Total.....	4,062.12	5,165.84	9,227.96

MISCELLANEOUS.

Removed 50,000-gallon water tank at Miraflores which was endangered by a slide; cleared Flamenco Island of brush; built re-enforced-concrete supports for 24,000-gallon water tank at Culebra Island; constructed drains in connection with the filling of swamp lands in the vicinity of Balboa; and surveyed grasscutting areas.

SANITARY WORK.

The work consisted of digging and cleaning ditches, laying concrete and tile drains, filling swamp lands, and other work of similar character, by the request of and in accordance with plans proposed by the sanitary department. The work executed is detailed in Table No. 34.

TABLE NO. 34.—*Statement of sanitary work performed.*

Class of work and location.	Quantities of work performed.	Division cost.			Unit cost.
		Labor.	Material.	Total.	
Cleaning earth drains:	<i>Linear feet.</i>				
Balboa.....	160,422	\$1,393.74	\$3.15	\$1,396.89	\$0.0087
Ancon.....	152,147	2,243.51	36.28	2,279.79	.0150
Corozal.....	116,469	1,984.09	8.81	1,992.90	.0171
Miraflores.....	89,661	2,224.63	2.95	2,227.58	.0248
Pedro Miguel.....	135,832	3,243.17	6.44	3,249.61	.0239
Total.....	654,531	11,089.14	57.63	11,146.77	.0170
Excavating new earth drains:	<i>Cubic yards.</i>				
Balboa.....	741	523.80	.....	523.80	.707
Ancon.....	1,144	649.83	19.63	669.46	.585
Corozal.....	863	693.17	14.45	707.62	.820
Miraflores.....	298	396.61	.....	396.61	1.331
Pedro Miguel.....	228	260.18	.....	260.18	1.141
Total.....	3,274	2,523.59	34.08	2,557.67	.781
Sweeping cement drains:	<i>Linear feet.</i>				
Balboa.....	236,522	369.57	2.03	371.60	.0016
Ancon.....	387,217	487.09	1.49	488.58	.0013
Pedro Miguel.....	3,270	12.43	.....	12.43	.0038
Total.....	627,009	869.09	3.52	872.61	.0014
Filling holes and swamps:	<i>Cubic yards.</i>				
Balboa.....	430	436.13	.....	436.13	1.014
Ancon.....	86	51.78	.....	51.78	.602
Corozal.....	178	140.33	.....	140.33	.788
Miraflores.....	18	16.61	.....	16.61	.923
Pedro Miguel.....	263	148.12	.....	148.12	.563
Total.....	975	792.97	.....	792.97	.813
Laying tile drains:	<i>Linear feet.</i>				
Corozal.....	200	41.52	18.00	59.52	.298
Ancon.....	70	36.48	11.28	47.76	.682
Total.....	270	78.00	29.28	107.28	.397

TABLE No. 34.—Statement of sanitary work performed—Continued.

Class of work and location.	Quantities of work performed.	Division cost.			Unit cost.
		Labor.	Material.	Total.	
Constructing cement drains:	<i>Linear feet.</i>				
Ancon.....	4,134	\$658.46	\$152.21	\$810.67	\$0.196
Corozal.....	960	101.66	67.72	169.38	.176
Pedro Miguel.....	70	29.13	9.17	38.30	.547
Total.....	5,164	789.25	229.10	1,018.35	.197
Repairing cement drains:					
Balboa.....		178.19	23.92	202.11	.....
Ancon.....		203.50	30.54	234.04	.....
Pedro Miguel.....		43.68	.....	43.68	.....
Total.....		425.37	54.46	479.83	.....
Cleaning culverts:					
Balboa.....		27.86	1.73	29.59	.....
Ancon.....		23.97	.....	23.97	.....
Corozal.....		25.00	.....	25.00	.....
Miraflores.....		85.35	.....	85.35	.....
Total.....		162.18	1.73	163.91	.....
Miscellaneous:					
Repairing tile drains.....		46.28	.60	46.88	.....
Installing pipe culverts.....		280.84	61.78	342.62	.....
Maintaining oil tanks.....		399.50	193.85	593.35	.....
Clearing land of vegetation.....	<i>Acres.</i> 112 $\frac{1}{4}$	3,685.68	112.37	3,798.05	33.69
Total.....		4,412.30	368.60	4,780.90	.....

RECAPITULATION.

Class of work.	Labor.	Material.	Total.
Cleaning earth drains.....	\$11,089.14	\$57.63	\$11,146.77
Excavating new earth drains.....	2,523.59	34.08	2,557.67
Sweeping cement drains.....	869.09	3.52	872.61
Filling holes and swamps.....	792.97	.....	792.97
Laying tile drains.....	78.00	29.28	107.28
Constructing cement drains.....	789.25	229.10	1,018.35
Repairing cement drains.....	425.37	54.46	479.83
Cleaning culverts.....	162.18	1.73	163.91
Miscellaneous.....	4,412.30	368.60	4,780.90
Grand total.....	21,141.89	778.40	21,920.29

FOURTH DISTRICT.

ANCON QUARRY AND CRUSHERS.

[J. A. Loulan, Superintendent.]

This plant has been operated throughout the year with a comparatively small amount of time lost for repairs. Within the past few months it has been necessary to operate a night shift occasionally for a week or two at a time in order to supply the demand for crushed stone. The performance of the plant is given in Table No. 35.

MINING.

The following work was done:

Drilling with power drills.....linear feet__ 70,740

EXPLOSIVES USED.

Dynamite.....gross tons__ 64.03

Black powder.....do____ 15.05

Total.....79.08

Average number of linear feet drilled per cubic yard.....0.064

Average number of pounds of explosives per cubic yard......160

TABLE No. 35.—*Performance of Ancon quarry and crushers.*

Month.	Number of 8-hour shovel days.	Average number of shovels.	Material excavated (cubic yards).		Number of cubic yards of rock crushed (car measurement).				
			Strip-ped.	Quar-ried.	Placed in stor-age.	Supplied other work.			Total pro-duction.
						Munic- ipal depart- ment.	Other P'acific divi- sion work.	Other divi- sions, depart- ments, etc.	
1911.									
July.....	49.0	1.96	3,855	61,362	56,441	64	3,370	1,487	61,362
August.....	52.0	1.90	15,390	58,962	58,755	.....	896	682	60,333
September.....	49.0	1.97	12,765	58,290	61,452	32	1,355	587	63,426
October.....	52.0	1.96	8,685	61,035	62,182	.....	1,389	875	64,446
November.....	48.4	2.00	10,125	56,490	57,746	48	1,819	817	60,430
December.....	50.0	2.00	7,980	62,670	60,591	16	4,138	1,356	66,101
1912.									
January.....	52.9	2.00	25,205	55,710	53,128	371	4,734	810	59,043
February.....	60.0	2.45	59,975	52,440	46,665	1,325	2,159	932	51,081
March.....	104.0	4.00	45,720	106,526	95,174	1,174	743	2,432	99,523
April.....	93.9	3.48	54,005	85,050	76,735	322	3,258	2,455	82,770
May.....	104.0	4.00	25,955	100,545	96,862	.....	2,277	3,163	102,302
June.....	72.5	2.88	20,720	65,360	57,087	.....	5,329	6,046	68,462
Total.....	787.7	2.55	290,380	824,440	782,818	3,352	31,467	21,642	839,279

FIFTH DISTRICT.

HYDRAULIC EXCAVATION.

[W. L. Thompson, assistant engineer.]

The hydraulic excavating plant has been in operation throughout the year in the sea-level section of the canal south of the Miraflores locks and has excavated 900,596 cubic yards of material. Of this amount 78,316 cubic yards were pumped into the west dam at Miraflores, and 822,280 cubic yards were deposited on the swamps east of the canal prism. The core of the west dam was completed on December 4, 1911, and contains a total of 625,048 cubic yards that have been deposited by the hydraulic plant. The remainder of the excavated material has been used for reclaiming 76 acres of tidal swamp land east of and adjacent to the canal prism.

TABLE No. 36.—*Hydraulic plant excavation.*

[Cubic yards.]

Month.	Excavated.			Deposited.	
	Lock.	Prism.	Total.	Dam.	Swamp.
1911.					
July.....		69,772	69,772	24,957	44,815
August.....		149,926	149,926	25,000	124,926
September.....		70,289	70,289	6,409	63,880
October.....		52,500	52,500	7,180	45,320
November.....		50,563	50,563	14,770	35,793
December.....		57,780	57,780	.....	57,780
1912.					
January.....		60,302	60,302	.....	60,302
February.....		60,915	60,915	.....	60,915
March.....		74,256	74,256	.....	74,256
April.....		88,727	88,727	.....	88,727
May.....		86,890	86,890	.....	86,890
June.....		78,676	78,676	.....	78,676
Total.....		900,596	900,596	78,316	822,280

SURVEYS, MAPS, AND OFFICE WORK.

SURVEYS.

During the past fiscal year surveys have been made for the terminal docks, machine shops, and dry dock at Balboa; also for the ditches and grass-cutting areas for the sanitary department, together with minor surveys of municipal improvements on the Canal Zone and in the city of Panama, and the usual routine progress surveys of dredging and excavation.

MAPS.

During the year the various existing division maps and those of the sanitary districts have been revised to indicate the changes made necessary by the progress of the work. Maps showing sanitary ditches and grass-cutting areas in the Corozal and Miraflores districts were completed; also profiles and maps relating to the installation of the 20-inch water main.

OFFICE WORK.

In addition to the routine work on progress records, estimates, specifications, requisitions, etc., for the various districts of the division, there have been prepared, when necessary, designs for numerous minor structures, detail working drawings for lock construction, mechanical designs for new apparatus and repair parts for the same, work-request drawings for shop orders, building permit plans, etc.

Detail drawings for snubbing posts, track fastenings, fenders, and all irregular beams and girders for the Balboa lumber dock were prepared; also drawings of wooden forms for the superstructure of that dock. Design and detail drawings were prepared of a plant for excavating and sinking pier shells for the foundation of the north approach wall at Miraflores.

Plans were made and details worked out for an auxiliary concrete mixing plant to be installed in a recess of the east wall of the lower lock at Miraflores, for a trestle incline connecting the upper and lower east chambers of Miraflores locks, for a trestle crossing the west chamber of Pedro Miguel Lock, and providing a track connecting with the south approach wall. An arrangement was devised and worked out in detail for lowering a chamber crane from the upper to the lower lock at Miraflores. Plans were made for forms for the cellular north approach wall at Miraflores; for a trestle connecting Naos, Perico, and Flamenco Islands; for a temporary dock and unloading plant at Naos Island; for an air compressor at Aguadulce; for a reenforced concrete tower to support a 24,000-gallon water tank at Culebra Island; for a pile-driving attachment for a locomotive crane; and for a special track crossing at Balboa.

Studies of different types of quay walls and an estimate of different layouts for the Balboa terminals were made. For the final design of the quay wall, influence lines, moment and shear diagrams were computed, and detail drawings of the typical members of the superstructure were made.

A total of 186 complete drawings were made and 3,583 blue and white prints issued.

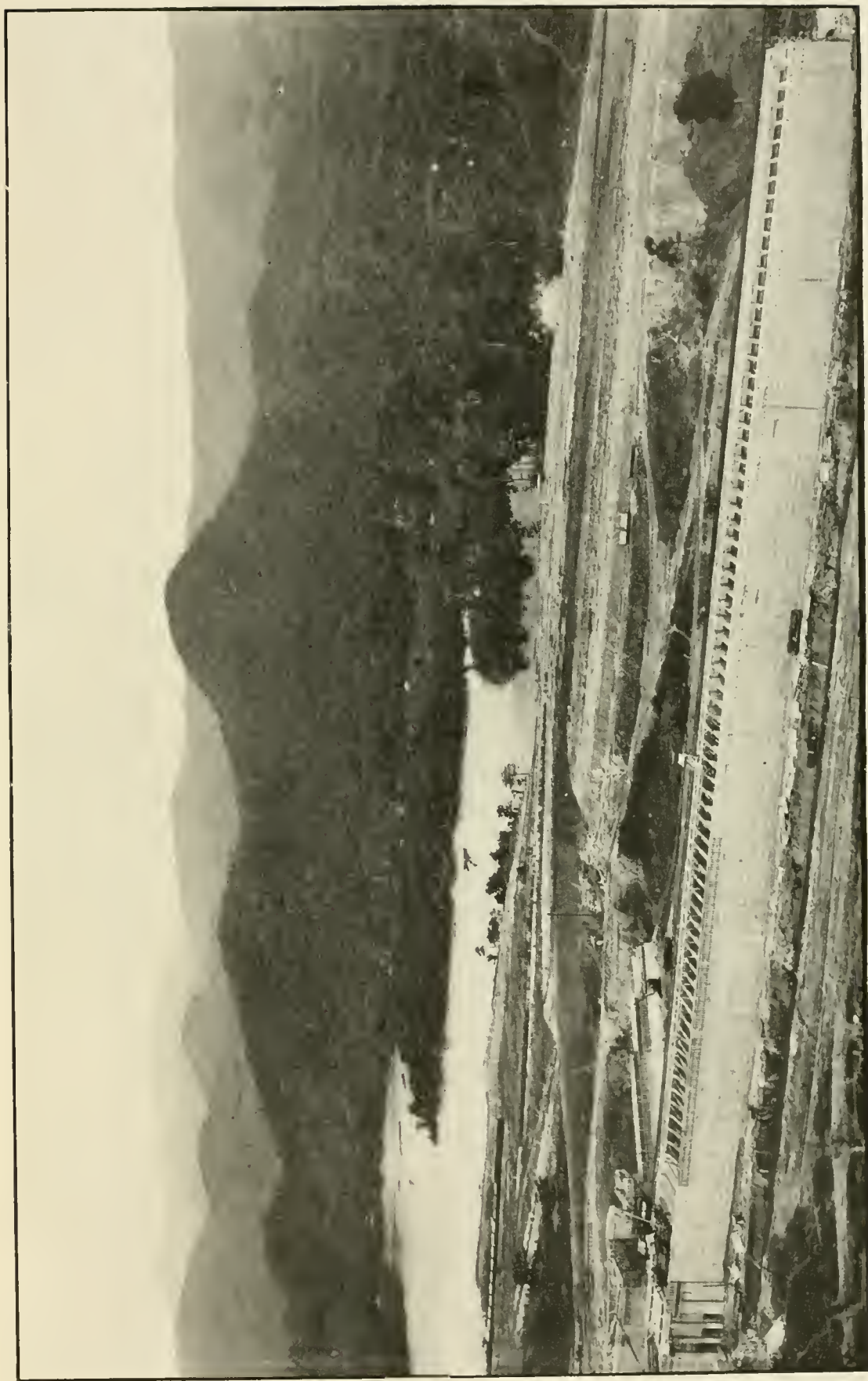
Respectfully,

S. B. WILLIAMSON,
Division Engineer.

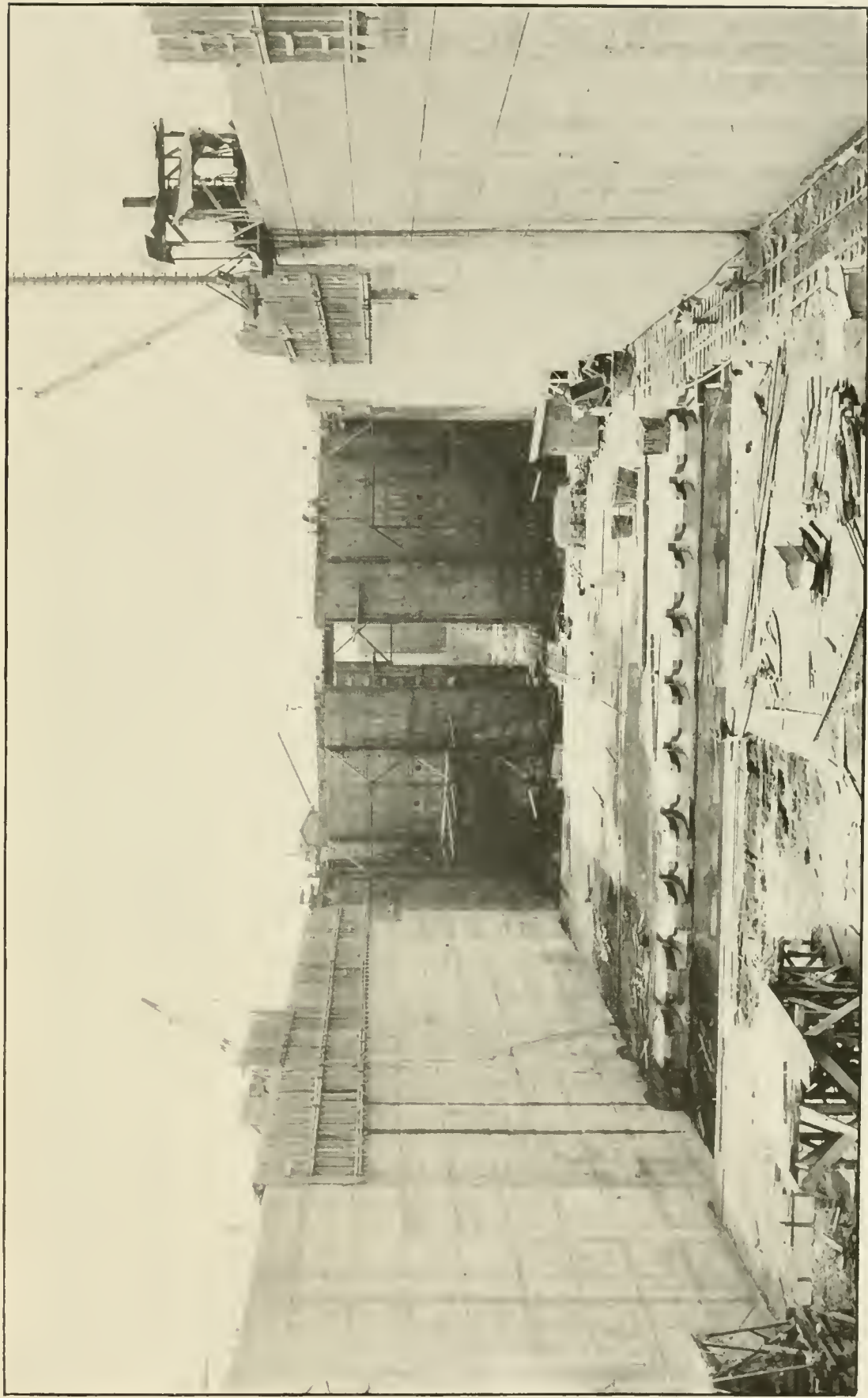
Col. GEORGE W. GOETHALS, United States Army,
Chairman and Chief Engineer, Culebra, Canal Zone.



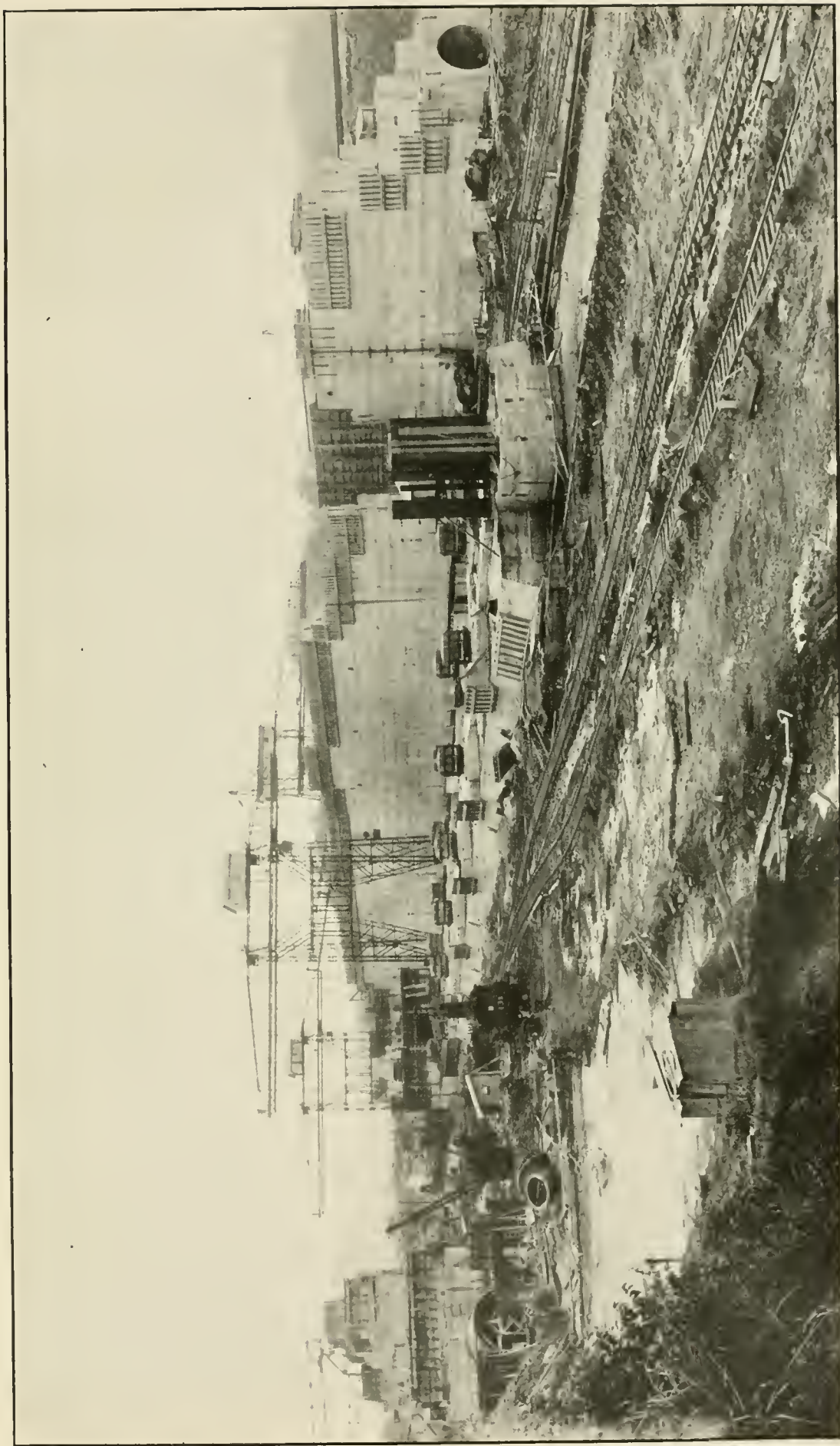
PEDRO MIGUEL LOCKS. BIRD'S-EYE VIEW FROM HILL ON EAST BANK. JULY 28, 1912.



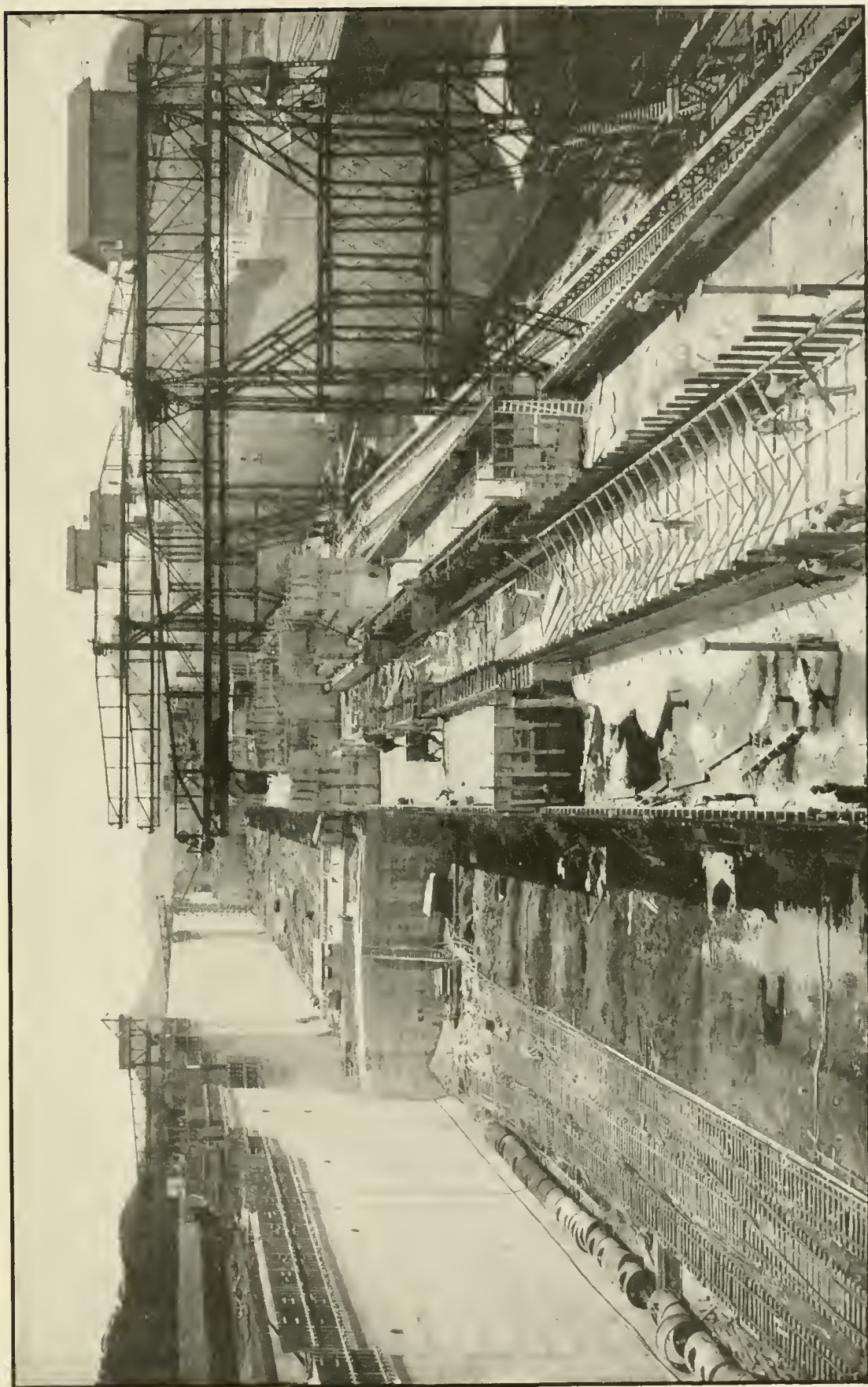
PEDRO MIGUEL LOCKS. BIRD'S-EYE VIEW OF NORTH APPROACH WALL FROM HILL AT EAST END. JULY 28, 1912.



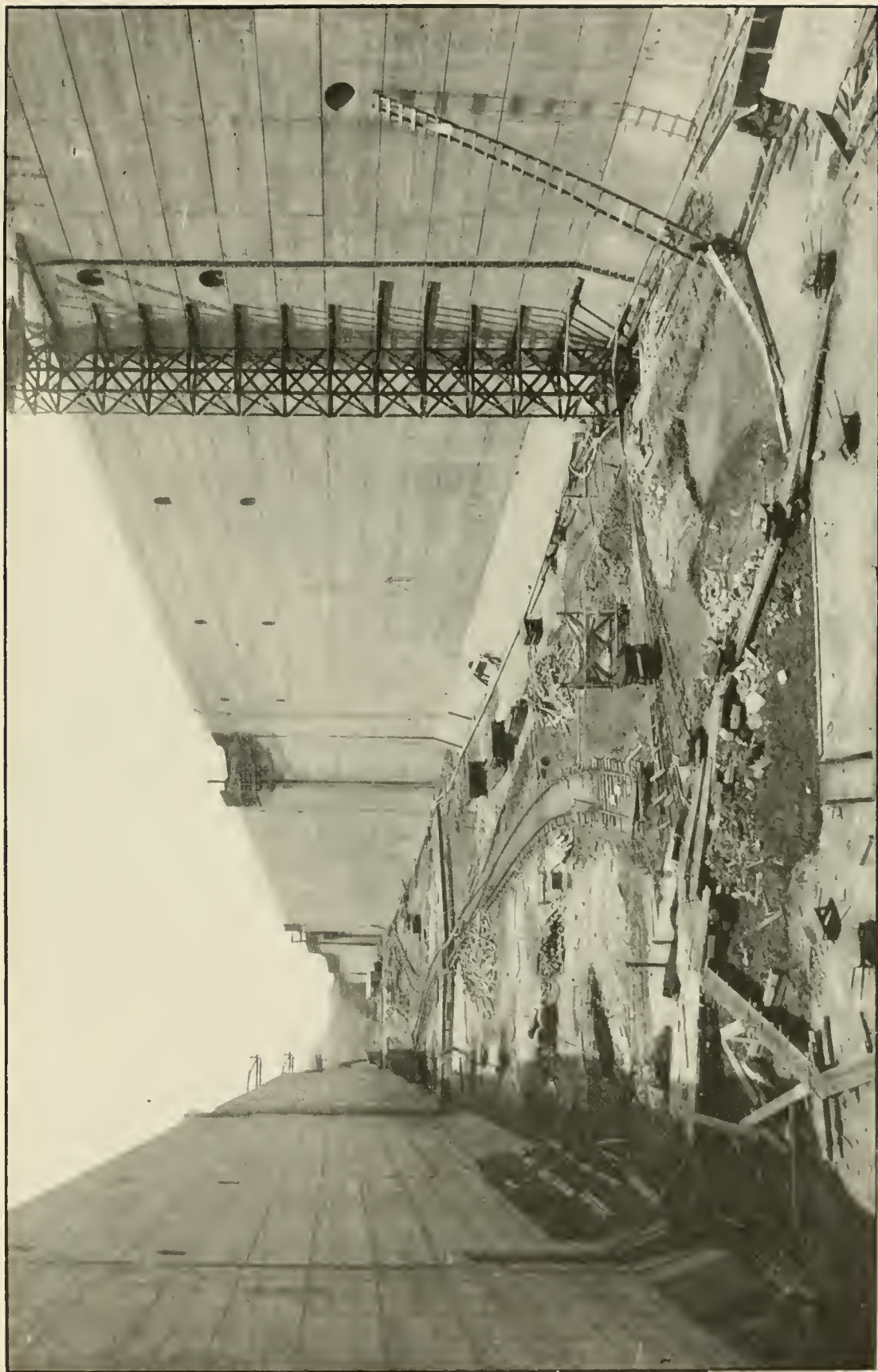
PEDRO MIGUEL LOCKS, LOOKING SOUTH. WEST FORE BAY, WITH EMERGENCY DAM SILL. JUNE 5, 1912.



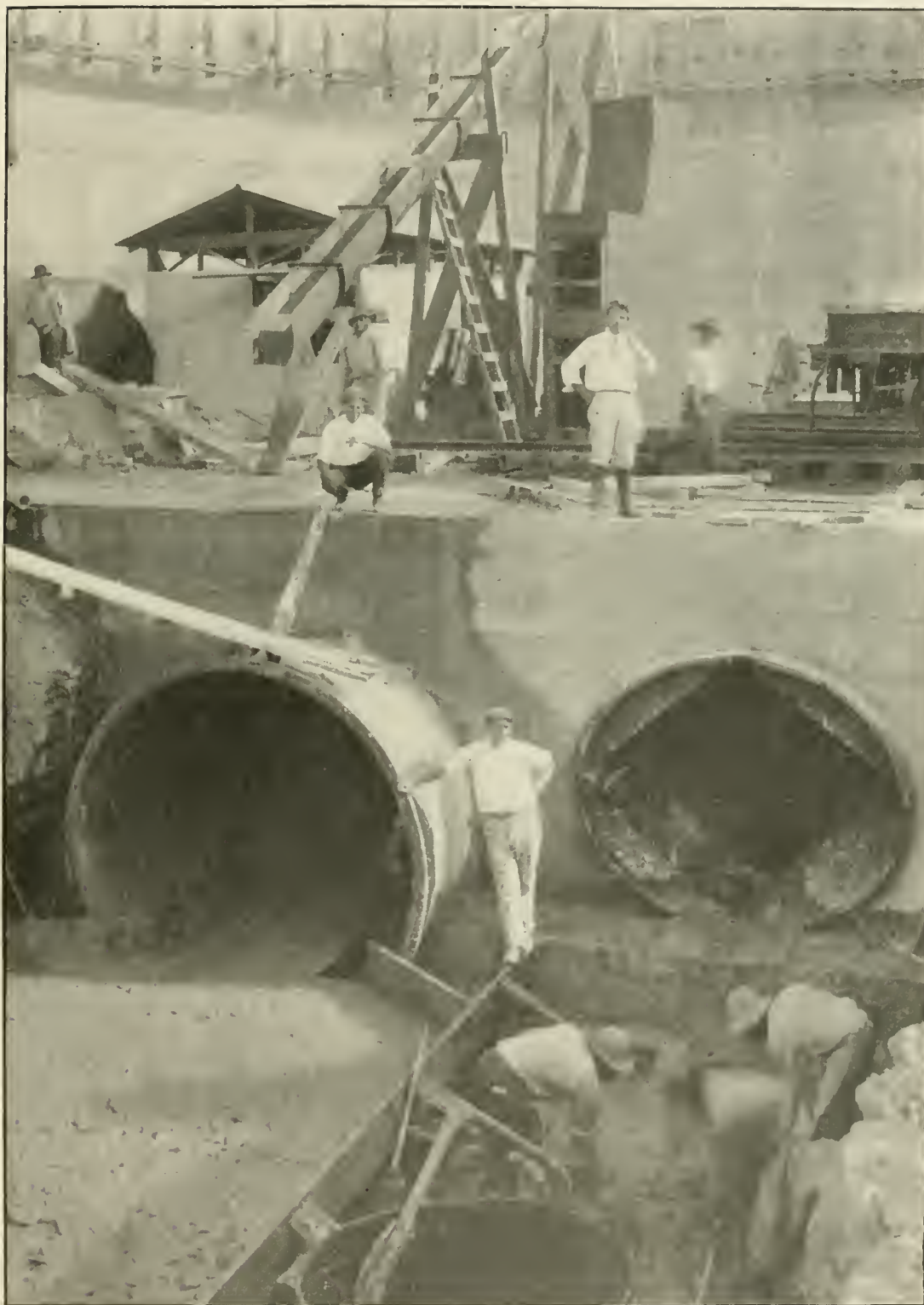
MIRAFLORES UPPER LOCKS. GENERAL VIEW LOOKING NORTH FROM LOWER WEST BANK, SHOWING CYLINDRICAL VALVES.
JULY 25, 1911.



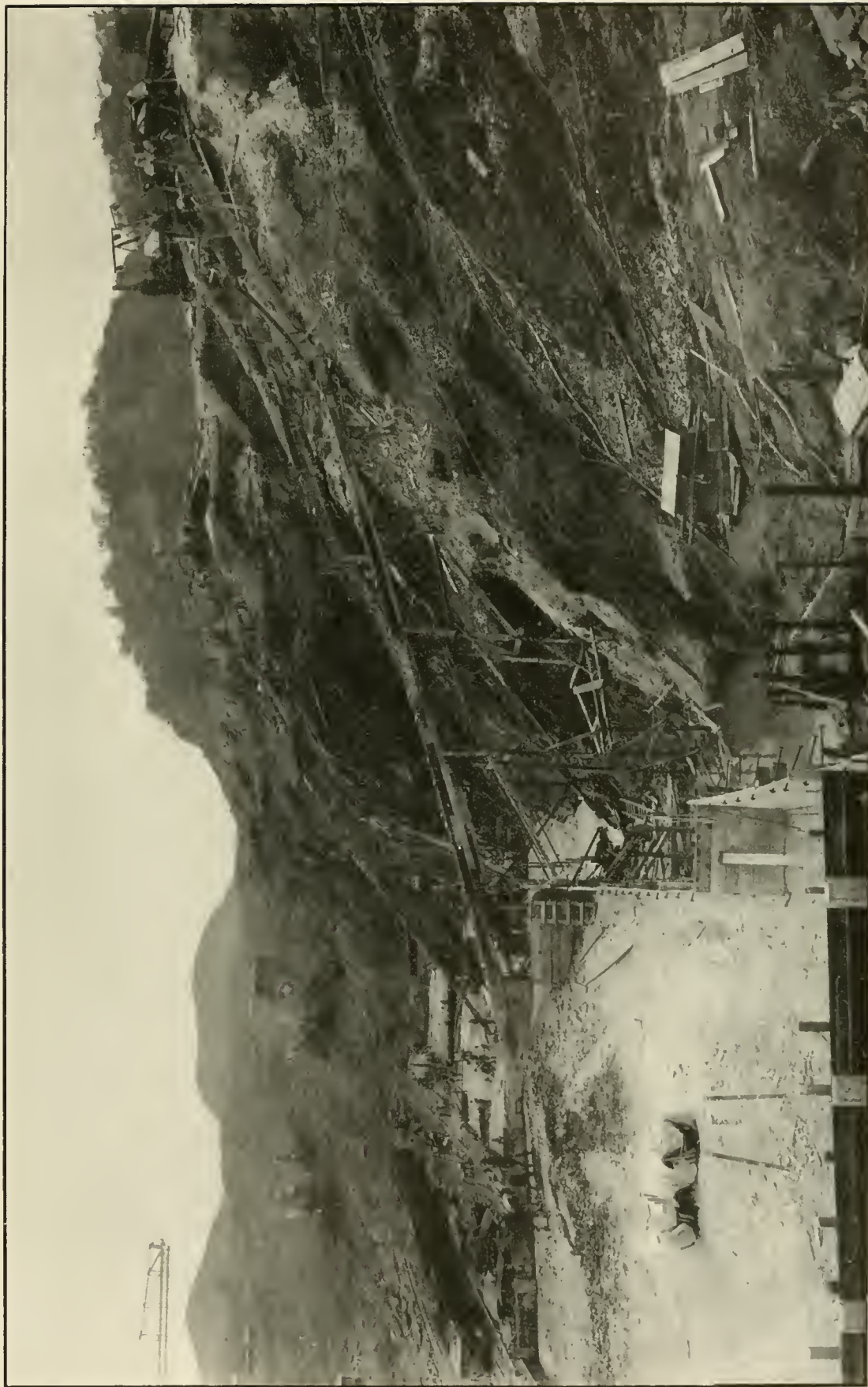
MIRAFLORES LOCKS LOOKING NORTH. JUNE 21, 1912.



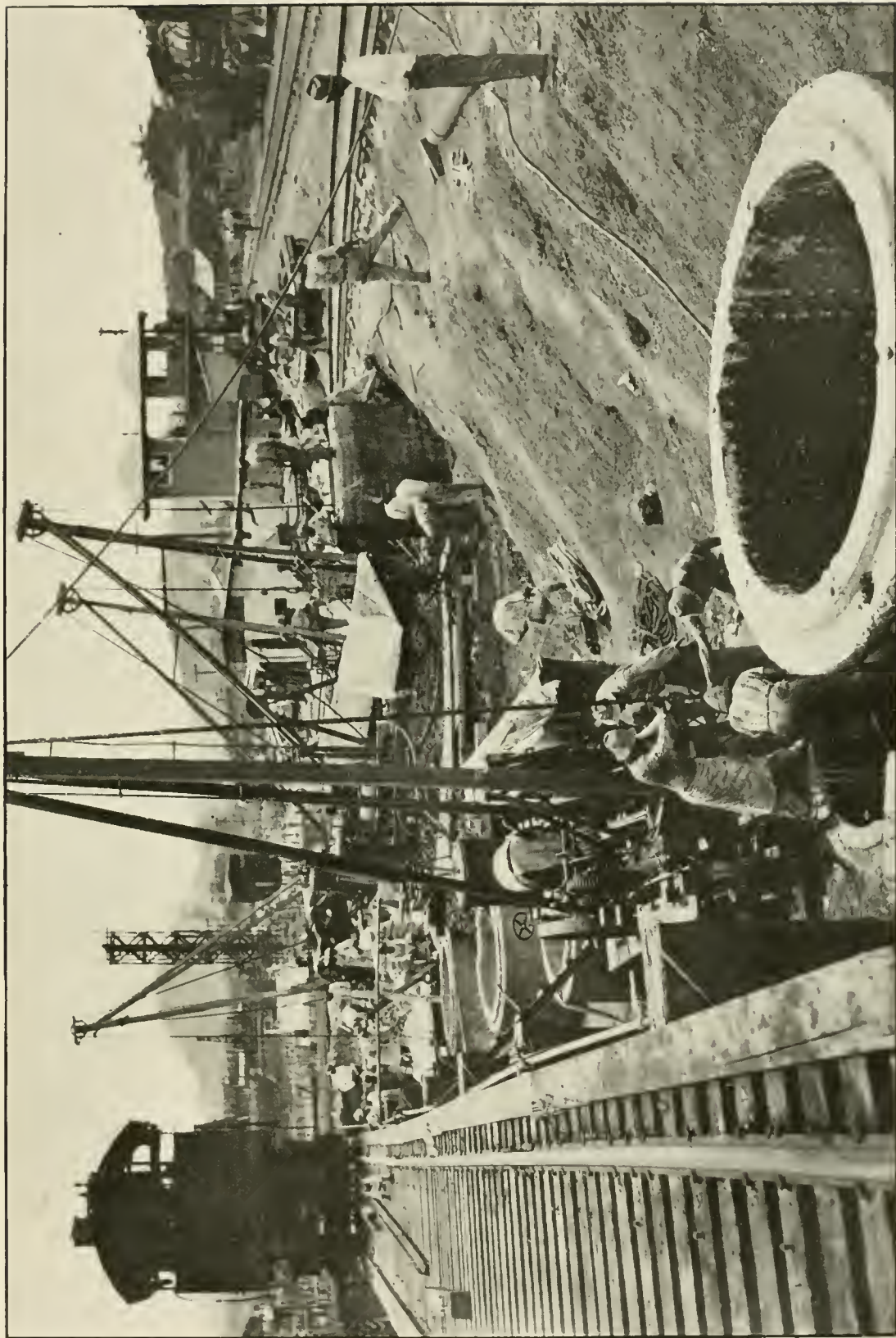
MIRAFLORES LOCKS, WEST CHAMBER, LOOKING SOUTH. JUNE 23, 1912.



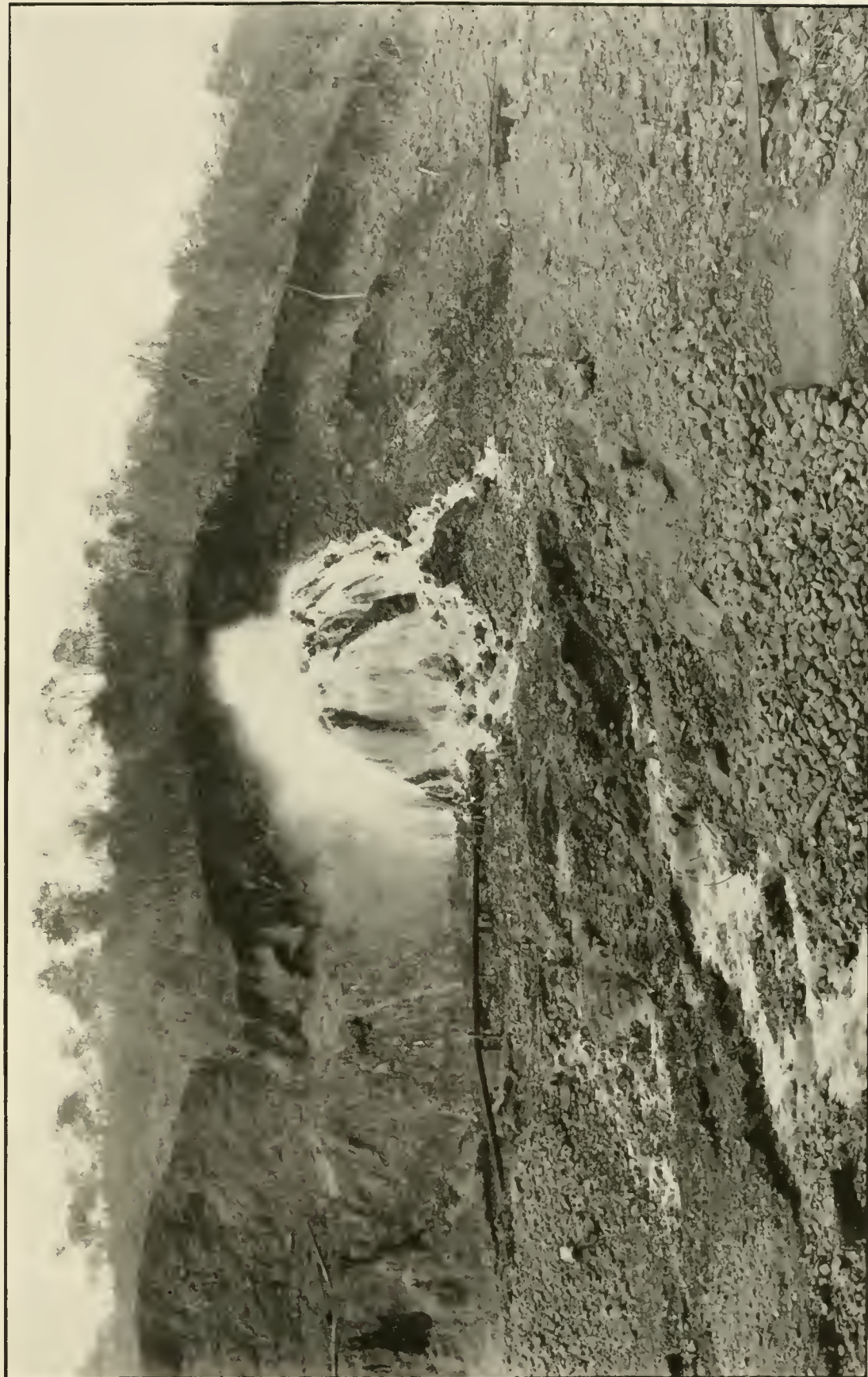
MIRAFLORES LOWER LOCKS, LOOKING EAST. ELECTRICAL CONDUIT AND FLOOR CULVERT AT UPPER END OF EAST LOCK. JANUARY 19, 1912.



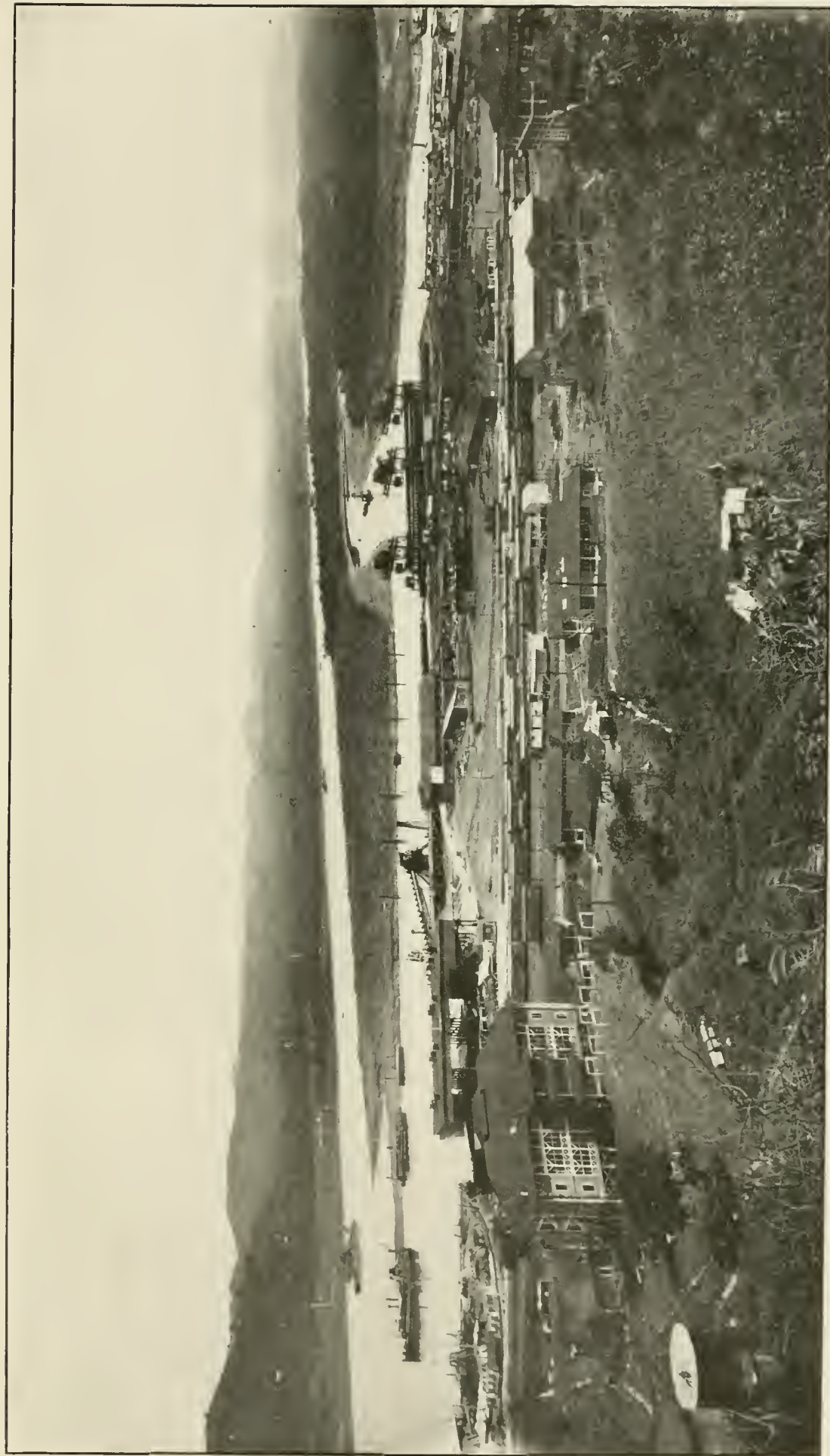
MIRAFLORES LOWER LOCKS. SLIDE BACK OF WEST WALL, LOOKING SOUTH. MARCH 21, 1912.



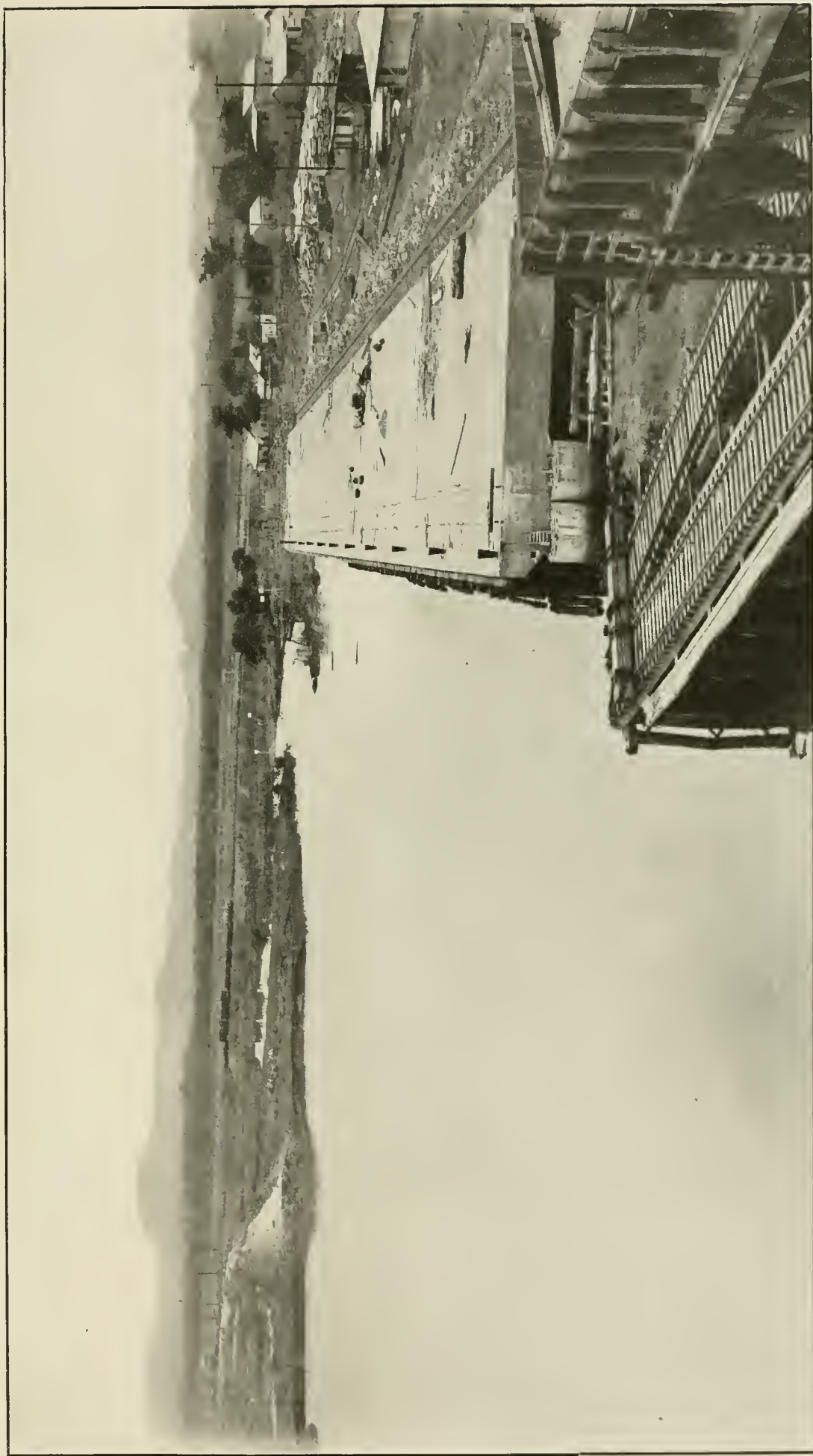
MIRAFLORES LOCKS. SINKING CAISSONS FOR FOUNDATION OF NORTH APPROACH WALL, LOOKING NORTH.
JUNE 14, 1912.



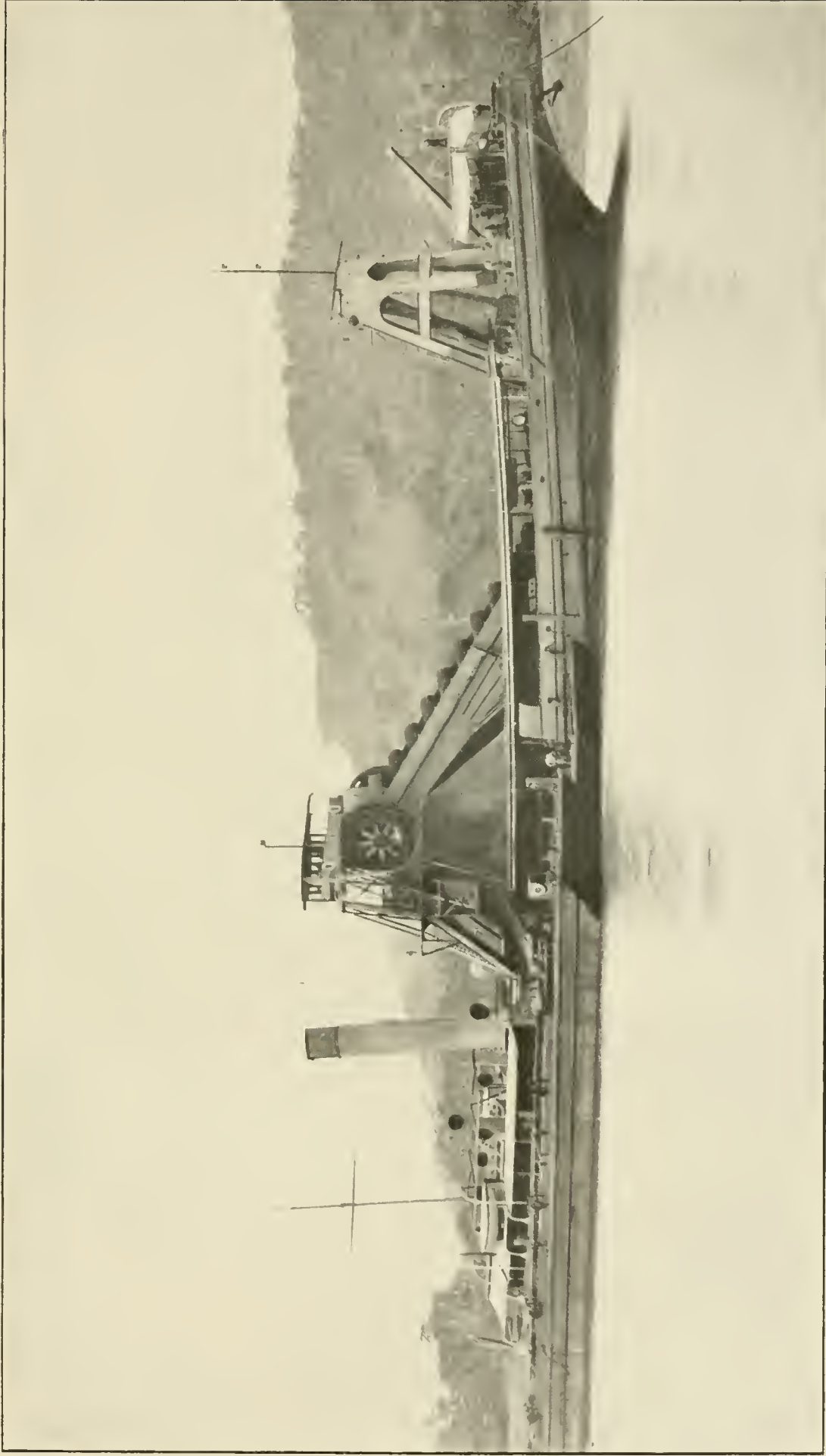
STRIPPING COCOLI HILL ADJACENT TO CANAL PRISM. MARCH 21, 1912.



GENERAL VIEW OF BALBOA TERMINAL SITE, LOOKING NORTH. JUNE, 1912.



BALBOA LUMBER DOCK OF REINFORCED CONCRETE, LOOKING NORTHEAST. JUNE, 1912.



DREDGE "COROZAL" IN CHANNEL NEAR STATION 2210. JUNE, 1912.

APPENDIX E.

REPORT OF DONALD F. MACDONALD, GEOLOGIST.

ISTHMIAN CANAL COMMISSION,
Culebra, Canal Zone, September 14, 1912.

SIR: I have the honor to submit the attached report on "The landslides of Culebra Cut," to accompany the annual report for the fiscal year ended June 30, 1912.

Respectfully,

DONALD F. MACDONALD,
Geologist.

Col. GEO. W. GOETHALS, U. S. Army,
Chairman and Chief Engineer,
Culebra, Canal Zone.

I. THE LANDSLIDES OF CULEBRA CUT.

The slides which have already occurred have added several millions of cubic yards to the original estimates for excavation of Culebra Cut, and the end of the sliding period will not be reached until that estimate shall have been swelled by several millions more. It is certain, however, that the period of sliding will come to an end, even where the rocks are very weak, when the slopes of the cut reach a flat enough angle, and that the sliding period will have run its course without involving any new or serious problems in excavation. It will be merely a case of removing a much greater yardage than was first estimated for, because the peculiar geological conditions of the material through which the cut is excavated were not sufficiently considered in the beginning. The slides are largely a result of certain geological conditions, so that to arrive at a clear understanding of them one must know something of the local geology, and to supply that knowledge the following brief account of it is given:

II. GEOLOGICAL CONDITIONS.

The oldest rocks are exposed along the canal between Bas Obispo and Empire. They consist of an extensive basic meta-conglomerate at Bas Obispo, overlain by a series of variegated volcanic agglomerates, tuffs, lava flows, plugs, dikes, and volcanic breccias, mostly of basic character, with greenish, light-gray, and brownish-red tints predominating, and all much faulted and sheered.

The axis of, approximately, a 500-foot downwarp of the bedded rocks trends across the canal near Gold Hill. The northern rim of this sag is the Empire breccias and the southern rim the basalt intrusions and breccias near Paraiso. This downwarp is not now a valley, for it was later filled, or covered over, with a land-deposited formation of very fine-grained, green volcanic clay, and the latter was intruded by basalt and breccias, all to be described later.

The downwarped rocks consist of dark, soft and friable, thinly bedded, carbonaceous clays and shales, containing some lenses of sand,

gravel, marl, and waterlain basic tuff. The thickness of this formation is not accurately determinable but is estimated at 250 feet. It grades upward into the next younger formation which consists of light gray, limy sandstone, and sandy limestone, beds and lenses, 3 inches to 3 feet thick, separated from each other by thin beds of friable, dark-gray, marly shale with, locally, considerable carbonaceous matter. Both these formations show fossil oysters, gastropods, pelecypods, corals, and foraminifera, all remains of a marine fauna of Tertiary, mostly Oligocene, facies. This proves that they were originally laid down as sediments in the bottom of shallow estuaries of the sea, and as the same fossil relations are found all across the Isthmus, it is evident that the Atlantic and Pacific Oceans were joined at that time. Pyrite occurs locally in these beds in very finely divided form, and where scattered through layers that contain carbonaceous material it has, on exposure of these layers to the atmosphere by drilling or blasting, become oxidized. This atmospheric oxidation has locally generated enough heat to ignite the carbonaceous matter and the smouldering of this continuing for from a few to several weeks, has produced a temperature locally high enough to ignite wood.¹ With the oxidation of all the carbonaceous matter the rocks have gradually cooled off.

The chief geological facts about these two series of bedded rocks, then, are their low crushing strength and comparative weakness, their subjectivity to weathering and erosive processes, and the fact that they were laid down in the bottom of an interoceanic passageway which at that geological time connected the Atlantic and Pacific Oceans across where the Isthmus now stands.

The last marine bed of rock which was deposited is a shell and coral limestone, found at intervals across the Isthmus, and locally worked as a quarry for road materials half a mile northwest of Empire station. At the latter place it is really a prehistoric coral reef, for it is there made up chiefly of ancient coral forms.

The sea receded from this particular area after the shell limestone bed was deposited, for overlying most of the above-described beds is a land formed, or subaerial deposit of greenish, fine-grained, basic volcanic clay rock over 400 feet thick, which fills the downwarp in the marine beds. This formation locally contains lenses and beds of gravel, sandstone, carbonaceous and lignitic shale beds up to 4 feet thick, an extensive flow of andesitic lava 20 feet thick and a few red beds. The whole formation is very weak, crumbly, and easily weathered. The lignitic shales show remains of land plants, and prove that subaerial swamp conditions existed at certain periods. The red beds are evidence that deposition lagged at times long enough for atmospheric oxygen to alter what was at that time the surface layer of green iron silicate into red iron oxide. The successive number, five or six, of these red beds tells how many old oxidized surfaces have been buried in the making of this one formation. Very little bedding, and that only local, is discernible in these volcanic clay rocks.

The youngest Isthmian rocks are intrusions, dikes, and local flows of basalt, also masses of volcanic breccia and meta-tuffs. The former are hard, dark rocks of fine texture and high crushing and tensile

¹ For detailed statement of this heating see Science, May 3, 1912, p. 701, "Heating of local areas of ground in Culebra Cut," by Donald F. MacDonald.

strength, except locally where much jointed. The breccia and meta-tuff masses are shattered, intruded, and somewhat metamorphosed crowns masses which have been punched upward in a cold condition through several hundred feet of soft overlying formations by intrusions of basaltic lava. Gold Hill and Contractors Hill are such forced up volcanic masses, and the breccias at Empire Bridge, at Paraiso, and at Office Hill, though less conspicuous, are also of this type. Both these hills were pushed up beyond the stability of their foundations, and there is geological evidence to show that they have gradually settled back some hundreds of feet to their present elevations.

In part contemporaneous with and in part later than these intrusions there was considerable faulting or breaking and displacing of the rock formations. These faults and displacements mostly cut diagonally across the canal almost at right angles to a line drawn between the center of Contractors Hill and the center of another lava mass, Zion Hill. The soft rock between these two cores of strong rock has been the zone of weakness along which fault breaks and adjustments have gone on and the locus of the intersection of the canal slopes by these fault planes is the region of greatest sliding.

In general, it is interesting to note that among the oldest rocks of the Isthmus are volcanic agglomerates and tuffs referable to volcanism of the explosive kind; then after a long period of rest volcanism of the quiescent type manifested itself by forming many dikes and intrusions. Many of the volcanic cores which were pushed up have since settled back some hundreds of feet below their former elevation. They have entirely changed the drainage, and, fortunately, where exposed in Culebra Cut, they stand as strengthening pillars to the weaker rock formations.

III.—TYPES OF SLIDES.

There are four distinct types of slide, each clearly differentiable from the other, yet each aiding and abetting the others, and all working together to pull down material from the high slopes into Culebra Cut, to squeeze material up in the bottom of the cut, or to do both. They are:

- (1) Structural breaks and deformations resulting in slides.
- (2) Normal or gravity slides.
- (3) Fault-zone slides.
- (4) Weathering and surface erosion.

1. STRUCTURAL BREAK AND DEFORMATIVE SLIDES.

(A) DESCRIPTION.

The structural break and deformative type of slide is by far the most important and most troublesome. Fortunately, they scarcely occur outside of the Culebra District, or, say, between Gold Hill and Empire. The first manifestations of these slides are the appearance of cracks or fissures parallel, or somewhat oblique, to the trend of the edge of the steep slope of Culebra Cut, and from a few yards to a hundred yards or more back from it and from each other. They are usually traceable on the surface of the ground for several hundred yards, and gradually widen out to form perpendicular crevasses sev-

eral inches wide. Locally one or more of these cracks may appear, and they may develop into the second stage in a few weeks or in a year or two, depending on the surrounding conditions. The second stage of this type of slide consists of a canalward tilting of the blocks, usually accompanied by a deformation or bulging up of the rocks in the bottom of the canal opposite them. There is a downward and a canalward movement of all the blocks, which reaches a maximum of, say, five feet or more at the edge of the cut. There is also a tilting forward toward the cut, on its own axis, of each block. This results in the ground on the canalward side of each crack being from an inch to 3 feet higher than the ground on the other side, as shown by Plate 59. These settling, tilting, and deformative movements go on for from a few weeks to a year before the third and last stage is reached. The last stage consists in the dropping downward of one or more blocks, due to the failure and squashing out of the basal part of each. Then the whole block disintegrates and soon becomes a normal gravity earth-rock slide piling up at the bottom of the cut. This last stage, once it is entered upon, runs its course in a few hours or, at most, within a few days.

(B) CAUSES.

This break-deformation type of slide is due to (a) a primal cause, the unstable geological condition of the rock formations through which the cut passes, attributable only to nature; and (b) an immediate cause, the oversteepness and height of the slopes, the blasting and other work, attributable only to man.

The first of these (a) depends on several geological factors, the chief of which are: (1) The rocks involved in these slides consist of rounded particles loosely cemented together; they have no interlocking crystal texture, hence have a very low crushing strength. (2) These rocks have been much weakened locally by faulting, especially the larger faults which cross the cut diagonally. The motion, more horizontal than vertical, along these fault planes has been sufficient to create sheared zones several feet wide, and these are distinct areas of weakness in the slopes. (3) These weak rocks deform or "flow" outward and bulge or swell upward in the canal bottom under comparatively low pressures. This deformation is accompanied by shearing and breaking, which destroys cohesiveness and allows ground water and air to permeate the interstices of the slowly moving mass. (4) Ground water and air tend to oxidize and further disintegrate the material, also to render it more slippery and unstable. (5) The lignitic shale beds, especially where they have any canalward dip, are slippery planes of weakness along which the overlying material tends to slip outward toward the cut.

The second or immediate cause (b) of this type of slide is chiefly the oversteepness of slopes where the banks are high and the rocks weak. Any excavation removes support from one side of the column of earth or rock which forms the slopes or walls of that excavation. In an excavation through granite the slopes or walls might be made perpendicular for depths of several thousand feet without their crushing in, but if such excavation were carried to depths of, say, 3 miles or more, perpendicular walls could not be maintained even in granite, for the unbalanced pressure at the foot of such walls would exceed the crushing strength of the rock, and crushing in of the lower

part of the excavation would result. The weaker the rock the less deep need be the excavation and the less steep the walls in order to cause crushing and deformation; and the critical depths and steepness for the rocks involved have locally been exceeded in the cut near Culebra. In the first estimate of excavation for Culebra Cut this weak-rock factor was not sufficiently considered. The earth vibrations set up by deep, heavy blasting near slopes already under severe strain have had considerable tendency to develop slides.

(c) REMEDIES.

For this type of slide there is only one remedy, and that is now being applied, namely: To make the slopes less steep by removing material from their upper portions, so that the unbalanced pressure toward the foot of the steep high cut banks shall be less than the crushing strength of the rocks involved. To do this several steam shovels have been put up on top of the banks on each side of the cut, and these are now terracing the upper part of the slopes, making them less steep and relieving somewhat their strained condition.

If the slopes have to be reduced any way it would seem reasonable at first sight to let the slides come down, and thus reduce blasting expenses and increase the output of yardage by shovelling them out from the bottom of the cut; in a word, let the cut make its own natural slopes; but there is another side to the question. Each slide of this type deforms and weakens the rocks down below the limits of the material which actually gets into the cut at the time, and this sheared and weakened rock requires much flatter slopes to maintain itself than would have been necessary had it not been strained by pressure and deformation. Also, each block as it crushes down generally leaves behind it not a gradual slope but a nearly perpendicular face, so that when the first slide is shoveled out the tendency for another block to crush down is not removed, and in most cases it is but little lessened. Another factor which enters into the cause of these large slides and deformations is time. Some of these movements run their course in a few weeks or months, but others have shown cracks for many months or even years and have not yet slid. These cracks and fissures are sources of weakness which sooner or later, especially after the cut shall have been deepened, may become troublesome unless remedied by reduction of slopes. The slides also involve the additional expense and difficulty of shifting and adjusting the railroad tracks in the cut so that the dirt trains may not be interrupted, and of keeping the drainage ditches clear. It is therefore very desirable that they be prevented if possible, or at least remedied as soon as practicable after they begin to manifest themselves.

The highest and steepest parts of Culebra Cut, namely, Gold Hill and Contractors Hill, afford evidence that they will not deform and crush into the cut. This is due to the fact that they are relatively strong rocks of volcanic origin with foundations which extend down deep into the earth. Rock loosened by joining, due to weathering and in part due to former heavy blasting, will from time to time drop from the steep parts of these hills, even to the extent of what might be called good-sized rock slides, but the hill masses themselves are solid and will stand.

In summary then, the structural break type of slide is due to over-steep slopes where the banks are high and the rocks weak. The remedy is to unload the unbalanced pressure and reduce the slopes. The ends to be accomplished by the remedy are, a reduction of the total excavation, for any rock will stand at a much steeper angle before being disturbed than after it has been weakened by deformation. Also, future slides may be avoided and extra adjustment of track and drainage systems in the cut be minimized by prompt application of remedial measures.

2. NORMAL OR GRAVITY SLIDES.

We now come to the second, the normal or gravity type of slide. Locally along Culebra Cut porous material lies on top of relatively impervious clay, shale beds, or dense lava masses. Rain and ground water may saturate the porous layers, but are impeded in their downward descent by the relatively impervious rock. This causes a muddy, slippery zone to form along the contact between the pervious upper and impervious lower layer, and if this zone slopes canalward, or if there is a thrust or head of pressure toward the canal from higher ground in the rear of it, a normal or gravity type of slide is almost sure to result. These slides differ from the structural break and deformational type above described in that they cause no, or very little, deformation of the underlying rocks, and therefore do not weaken the permanent slopes of the canal. There is no remedy for these slides except to shovel them out as they come down and keep them as well drained, if such drainage can conveniently be accomplished, as is possible. Generally no saving of excavation can be accomplished by removing material from the top part of them.

Although a few years ago very troublesome, this type of slide is not now relatively important. Among the largest of them that have been active are: Cucaracha slide, which gave trouble to the French company in 1887, and which reached a maximum areal development of about 52 acres. More than 2,000,000 cubic yards of clay and surface débris have slid into the cut from this slide since it first became active. The end of its activity is now well in sight, however, because the loose surface stone and clay have mostly slid off, exposing several large dikes and flows of basalt which will successfully maintain in place most of the remaining material. At Paraiso a slide of this type existed because a canalward dipping lignitic shale bed and some faulting allowed the loose surface material to slide into the cut every time the latter was deepened. This slide also is now practically dead. A prehistoric valley with a canalward pitch of about 20 degrees was intersected by Culebra Cut near Las Cascadas. Porous, grayish, volcanic tuff filled this old valley and its floor was of relatively impervious clay rock which the rain easily converted into mud. When the porous material became saturated it slid off its relatively frictionless base into the cut. This slide soon ran its course and is now dead. Many other slides of this type have occurred and some others are still to come, but it is believed they will not be of large size.

3. FAULT ZONE SLIDES.

The third type of slide is that occasioned primarily by sheared and weakened zones in the rocks due to fault displacements. As the rock masses moved past each other in the adjustment of earth

blocks, the frictional pressure was often great enough to crush and shear the material for several feet on each side of the plane of movement. Where the fault plane cuts diagonally across the canal large masses of rock in the acute angle between the fault plane and the plane of the canal slope generally fall out into the excavation; or where the fault plane dips the overhanging rocks often crush down into the canal. As previously explained, these fault zones cutting the weak rocks near Culebra are important factors in producing slides of the structural break or deformation type.

The most notable slides of the fault zone type, though they also belong in small part to the structural break type, are the La Pita slide, and the recent large slide which occurred about 600 feet north of La Pita, between Empire and Las Cascadas on the east side of the canal. In both cases a brownish breccia locally covers a dark gray volcanic agglomerate to a depth of 60 feet; the whole forming an almost perpendicular bank of 90 feet at La Pita, and of more than 125 feet where the recent slide occurred. In each case, but especially at the more recent slide, a fault crosses the cut in a direction somewhat diagonal to the trend of the Canal. The differential movement of the rocks along these fault planes had sheared and weakened them. These planes of shearing dip northerly at an angle of about 60 degrees, thus leaving a weakened overhanging mass which in each case rested insecurely against the rocks from which it had been faulted off. A diversion ditch on top of the bank comes within a hundred feet of the slope here, and the water from this leaked out in places along the breccia-agglomerate contact, but chiefly along the sheared fault zones. In the case of the recent slide the basal agglomerate contained peculiar volcanic mud-lava flows which on cooling had assumed columnar jointing (plate 60), and these joints afforded channels for the invasion of seepage and ground water. The water softened the agglomerate, especially down near the foot of the slope where it was already weakened by the fault zone and under great strain from the overhanging mass. The result was that the basal agglomerate failed and crushed down under the weight of a huge block of the breccia which contained about 20,200 cubic yards in the case of the La Pita slide, and 300,000 cubic yards in the case of the recent slide.

Slides which may exclusively be classed under this heading are not common, which is fortunate, for seldom can any economical remedial measures be applied to them.

4. SLIDING GROUND DUE TO WEATHERING AND EROSION.

The last type of sliding ground is that which is due to weathering and erosion of the steep unprotected slopes of Culebra Cut. The rocks of the cut are mostly basic, and contain iron and magnesia compound in considerable amounts. The iron compounds are largely in the ferrous form and give to the rocks dark and green shades of coloring. On exposure to the moist atmosphere, these ferrous compounds are oxidized to the ferric condition, with change of volume, and consequently a crumbling of the material so charged takes place. This, coupled with the soluble character of the limy cement present in varying quantities in most of the beds, seems to be the chief reason for the very rapid weathering here of all except

the dense volcanic rocks. This rapid weathering soon covers the surface of the slopes with a layer of crumbled and disintegrated rock. The heavy tropical rains wash this loose material into the cut and thus fresh surfaces are exposed for further weathering action. Of course, the amount of material washed down in this way is not sufficient to be a problem in canal construction, but unless remedied, it would add something to upkeep charges. If sediment washed into the canal in this way were evenly distributed over the bottom of Culebra Cut, it is estimated that it would average close to 2 inches per annum during the first few years. At 1.8 inches the total deposit would be 65,000 cubic yards, which at 25 cents per cubic yard for removal would add \$16,250 to maintenance. These figures are given as a conservative estimate merely to point out some practical features of the erosion problem, and they are substantiated by the records of the sedimentation which occurred between 1889 when the old French company quit and 1894 when the new French company began work. Fortunately nature here provides a remedy for this surface erosion in the luxuriant vegetable growth of the region. It is well known that even steep slopes suffer relatively little erosion, if they be well carpeted with a thick vegetable growth. It has therefore been proposed to promote the growth of vegetation on the permanent slopes of the canal where necessary, and thus settle the question of trenching and wash by heavy rains.

Another large erosion problem is that which will result along the water's edge from the wash of steamers going through the canal. In the softer rocks this wash will be considerable, unless a protective covering is used. Certain difficulties inherent in the geological character of the rock formations will have to be reckoned with in planning this protection, namely, the rocks will oxidize and swell in a more or less uneven way. The reason why lack of uniformity will characterize this movement is that weathering will progress most rapidly where fissuring and jointing have opened up the rocks most. Also, the different types of rock will be affected differently. Small swellings and movements of the slopes, which will not necessarily result in slides, will also occur. These will be due to the new conditions of rock pressure created by the excavation.

It is certain that no practical system of revetment work or retaining walls would prevent the large slides. Still there is no reason why a protecting revetment along the water's edge where the rocks are crumbly, designed to allow for the various rock adjustments, can not be adopted. A thin veneer of cement spread on the slopes from a cement spraying gun was tried, but without success. Within a few months the thin coat of cement thus put on began to crack and peel off, due to the following causes:

- (1) Oxygenated surface waters seeped through the thin coating and through the rock and oxidized the latter along its contact with the cement, thus causing the adhesive zone or contact to become loose and crumbly and very insecure.

- (2) Irregular swelling of the rock, due to oxidation, adjustment of pressures, etc., cracked the cement veneer and further weakened it.

- (3) Blasting vibrations tended to crack and scale it off.

The turning of the water into the canal will remedy the slides in so far as it will provide cheaper methods of excavation and removal of them by dredging. The counterbalancing effect of the water

against the slopes of the canal will be very small so far as the slides are concerned, for the following reasons: The maximum depth of water in Culebra Cut will be 45 feet, and the height of the slopes where sliding might occur is from 75 to 300 feet. The sliding material has an average specific gravity of about 2.5, hence 45 feet of water would balance about 18 feet of slide if the pressures were evenly distributed. Considering the more or less wedge-shaped fronts and the back pressures of many of the slides, it is estimated that the 45 feet of water would be equivalent to only about 10 feet of slide pressure. Other considerations are that, though the water will protect the lower part of the canal from oxidation and weathering, thus removing a small source of weakness, it will cause water to permeate under pressure the cracks and interstices at the foot of the slope and thus be an added source of weakness—though not a serious one—to the slides. On the whole, the water in the canal will slightly increase the tendency to slide, but this will be much more than offset by the cheaper methods of excavation and transportation which can then be used.

There is another geological principle which, because it plays a considerable part in most of the slides, except where the material involved is largely coarse grained, will be treated here in a paragraph by itself. Running water acts as a mill to grind finer and finer the rocks, pebbles, and sediment which it transports, until the limit of fineness is reached. This limit is that very minute size which may be included in a water film where such particle would be held captive by the surface tension and cohesion of the minute containing water drop. The cohesion or tensile strength of water, small though it is, may popularly be illustrated by observing a drop of water cling to the end of a pencil or glass rod until it finally grows large enough to overcome its cohesive force and fall off. A small fragment of paper may be held suspended by the cohesive force of a drop of water holding on to the paper below and the glass rod above. By virtue of this physical principle, a very small particle of solid material can be held in the center of a small drop of water and will stay there until the water evaporates or has its surface tension destroyed. The result of a cubic yard of such minute particles enveloped in water films would be so much ooze, or very fine mud, which would drain out with very great difficulty. In general, the finer the grain of any geological material the more difficult it becomes to drain.

Now, the bedded rocks of Culebra Cut have in them a considerable proportion of very fine material which is not solidly cemented together, particle to particle; especially is this true of the green argillaceous clay rocks near Culebra. This fine-grained material will stand fairly well, and comparatively steep, and is relatively impervious to water until it begins to crush and deform, then the small particles become loosened and separated from each other, and after movement has gone on for a considerable period the particles that are small enough become, whenever conditions are favorable, enveloped in a film of ground water. Now, every particle so enveloped is an added impetus toward the consistency of mud and toward a weakening of the stability of the whole. Where these conditions have been a factor in the production of slides, the top part of the moving ground may be comparatively dry and crumbly while the deeper parts of it may be in a pasty condition.

With this explanation it may again be stated that mud, or normal surface earth-rock slides which do not deform the underlying material over which they move, need receive no attention so far as preventive remedies are concerned; in fact, very seldom can anything be done to prevent or lessen them. The real difficulty lies in the deep breaks and movements of large slides which cause deformations of the material in the bottom of the cut and far below its bottom. Every such deformation is, because of the operation of the above stated principle on the large percentage of fine material in the rocks, an added weakness, a progression toward greater instability as deeper excavation is attained.

This, then, is, in some detail, the chief reason why all deformation weakens the peculiar type of bedded rocks which occur in Culebra Cut; and this, in addition to other reasons already given, is why, from the geological point of view, it will be a great saving in the end to prosecute with vigor the lightening up process on the upper slopes which has been carried on for some time, the chief end in view being that deformations of the bottom and deeper rocks may be lessened or prevented and thus better conditions for permanent slopes in the future be established.

IV. BLASTING—ITS EFFECTS ON THE SLIDES.

Two sets of waves are propagated from each blast—one atmospheric, the other earth waves. The former arrive with the noise of the explosion, showing that they move with about the same velocity as sound; the latter travel much faster. The earth waves affect the seismographs in a way that shows they are movements more compressional than undulatory. These compressions and expansions passing through an already strained rock very considerably promote its tendency to deform or crush. The deeper the blast, other things being equal, the less the proportion of its energy which goes into atmospheric waves. Atmospheric waves are harmless so far as the slides are concerned, though they jar houses more sharply than the earth waves.

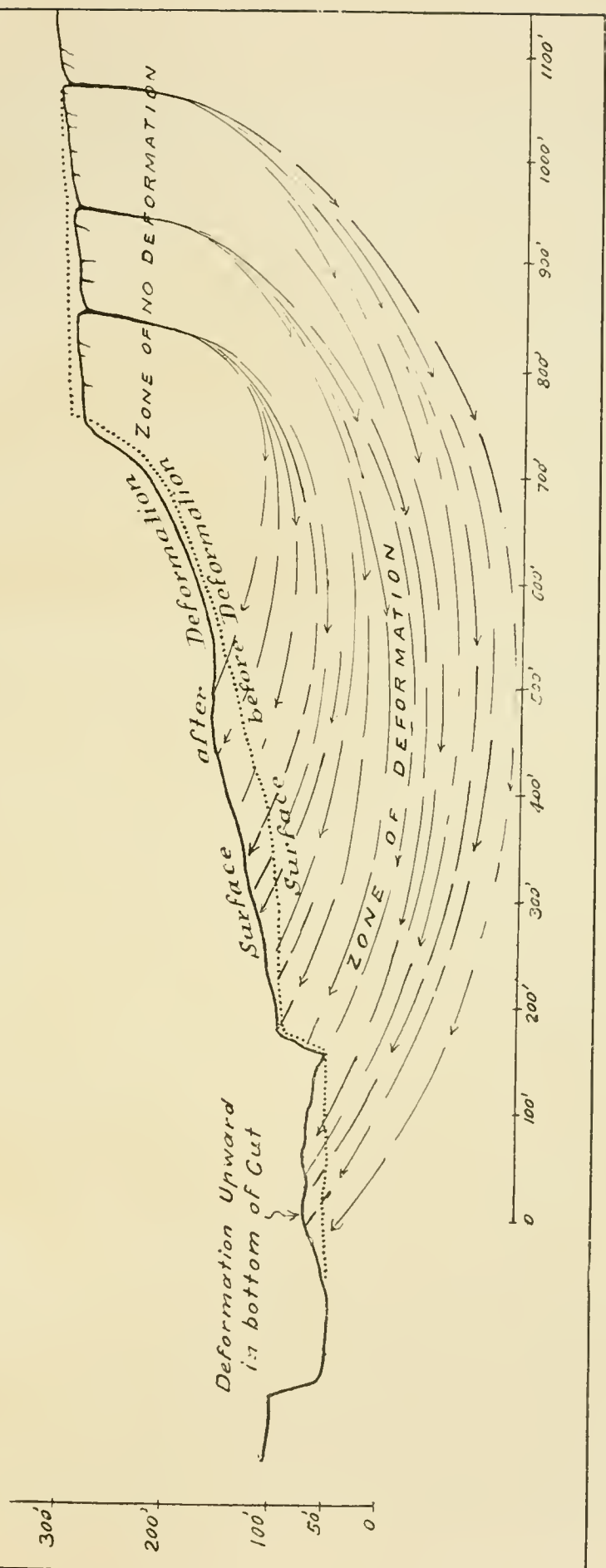
In general, the effects on the slides due to blasting increase in proportion to the depth of the holes, the amount of the charge, and the proximity to high, steep banks where the rocks are weak and already considerably strained. Fewer holes are now exploded in each blast than formerly, and this method gives better results under present conditions.

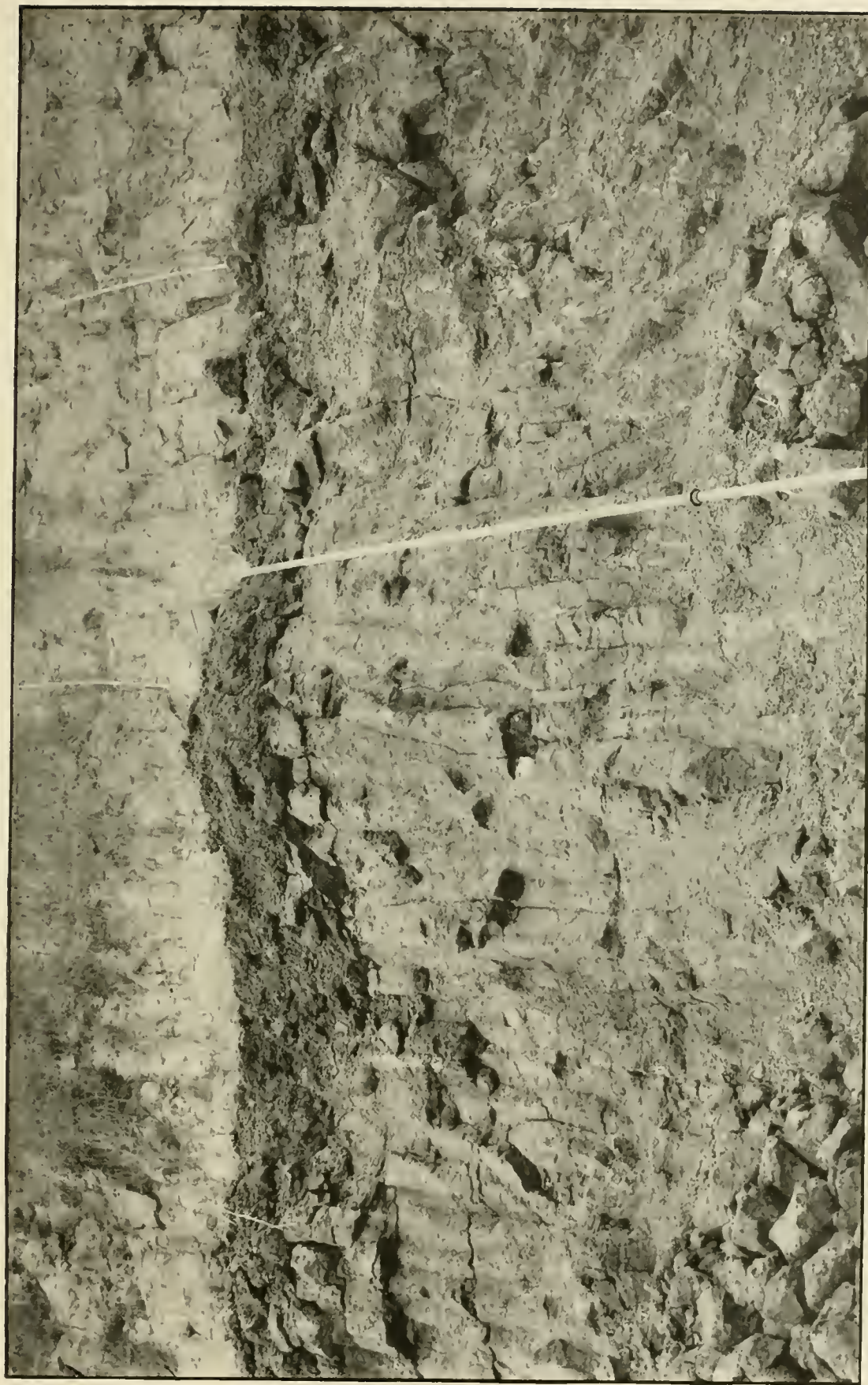
V. CONCLUSION.

When the slopes shall have been reduced to the proper angle, which will, of course, vary with the strength of the rock from almost perpendicular in the case of the strong lavas to 1 on 5 in the soft rocks, or, say, even 1 on 10 in a few extreme cases of the much-sheered clay rocks where deformation has further weakened them, the slide problem will be practically solved. With slope pressures thus finally adjusted and a protective mantle of vegetation minimizing erosion on the banks, there is no reason why Culebra Cut shall not be as stable and as enduring as similar valleys formed by nature's sculpturing hand.

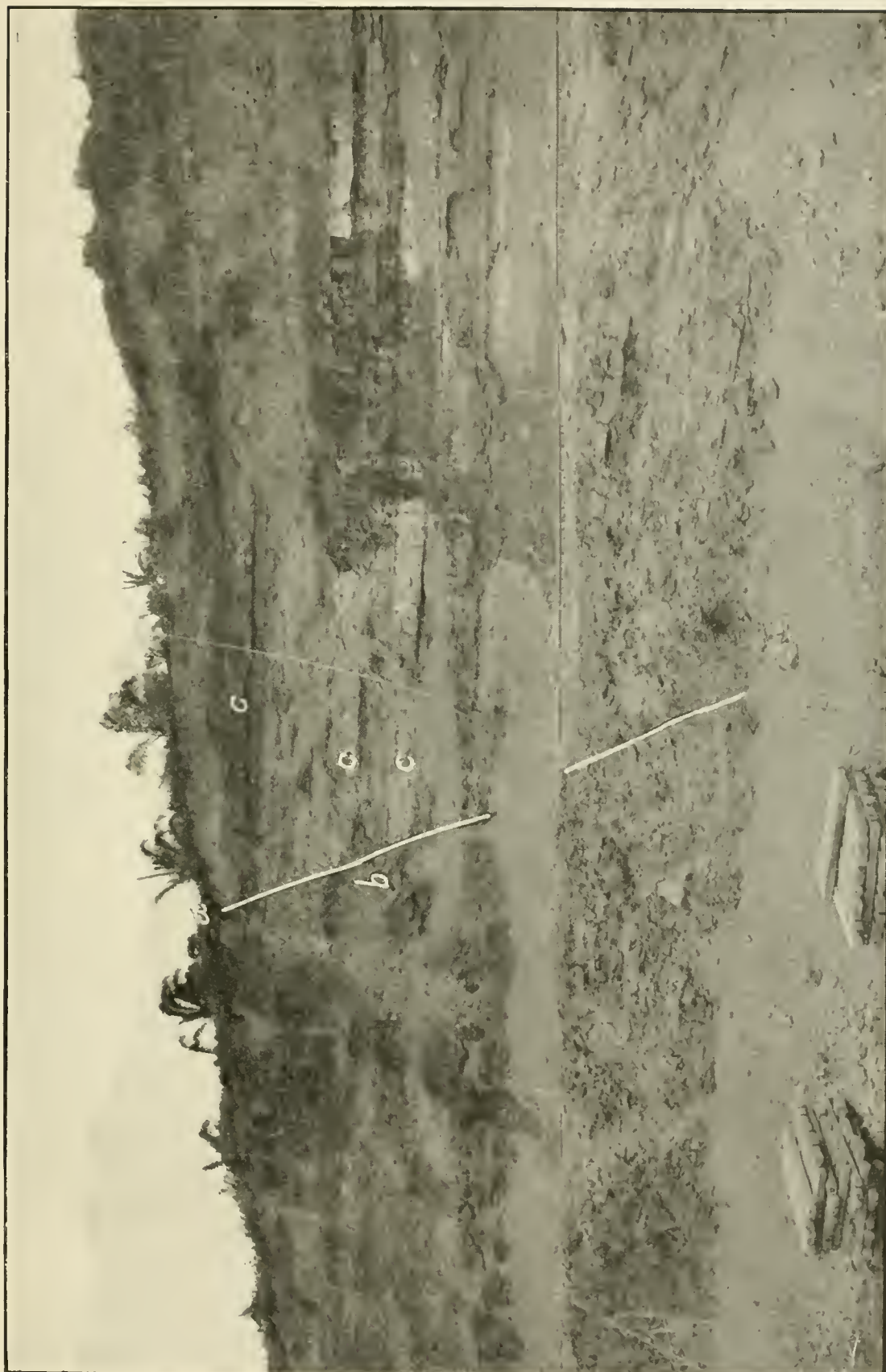
Plate 59.

Ideal Section of Deforming and Sliding Ground near Culebra, C.Z.





COLUMNAR STRUCTURE IN HARDENED FLOWS OF MUD LAVA. THIS JOINTING AFFORDED PASSAGES FOR SEEPAGE WATER WHICH SOFTENED THE BASAL MASS, ALREADY UNDER HIGH PRESSURE, AND THUS TENDED LARGELY TO PROMOTE THE RECENT LARGE SLIDE JUST NORTH OF LA PITA.



"A" FAULT PLANE. "B" CRUSHED AND SHEARED ZONE OF ROCK. "C" STRONGER ROCKS, BEDS OF LIMY SANDSTONE. THIS FAULT IS THE CHIEF CAUSE OF THE BIG SLIDE ON THE WEST (OPPOSITE) SIDE OF THE CANAL NEAR LIRIO. THERE THE OVERHANGING ROCKS ARE NOT STRONG LIMY SANDSTONES BUT RELATIVELY WEAK CLAY ROCKS, SO THEY EASILY SLIDE OUT ALONG THE PLANE OF THIS FAULT.

APPENDIX F.

REPORT OF CIVIL ENGINEER H. H. ROUSSEAU, UNITED STATES NAVY, MEMBER OF ISTHMIAN CANAL COMMISSION, ASSISTANT TO THE CHIEF ENGINEER, IN CHARGE OF THE SECOND DIVI- SION OF THE OFFICE OF THE CHIEF ENGINEER.

ISTHMIAN CANAL COMMISSION,
OFFICE OF THE CHIEF ENGINEER, SECOND DIVISION,
Culebra, Canal Zone, August 31, 1912.

SIR: I have the honor to submit the following report for the second division of the office of the chief engineer for the fiscal year ended June 30, 1912.

The total specific appropriations by Congress available to June 30, 1912, amounted to \$293,561,468.58, or 78 per cent of the total estimate of December, 1908, of \$375,201,000. By act approved August 24, 1912, additional appropriations were made for the fiscal year 1913 amounting to \$28,980,000, exclusive of fortifications, leaving \$52,659,531.42 of the total estimated cost of the canal to be appropriated hereafter, or 14 per cent.

To June 30, 1912, the classified expenditures, i. e., expenditures under general account No. 1 which have been charged into the work, amounted to \$259,653,236.74, or about 69 per cent of the total estimated cost. Of this amount \$34,183,183.48 were expended during the fiscal year 1911, or about 9 per cent of the total estimated cost of the canal. The difference between the appropriations available to June 30, 1912, and the classified expenditures to June 30, 1912, amounting to \$33,908,231.84, represents such items as unexpended balances of appropriations, unexpended material and supplies in storehouses, and other items reported as "unclassified expenditures" under general accounts other than general account No. 1, which are not yet properly chargeable against construction work. They are listed in Table No. 2 of the examiner of account's annual report.

The quantity of work performed to June 30, 1912, for the three principal items of excavation, concrete, and fill in dams, the total quantity to be performed, and the amount performed during the fiscal year 1912 are as follows:

Item of work.	Estimated total quan- tity as of July 1, 1912 (cubic yards).	Completed to June 30, 1912.		Performed during fiscal year 1912.	
		Quantity (cubic yards).	Per cent of total.	Quantity (cubic yards).	Per cent of total.
Excavations:					
Dry.....	125,735,000	108,309,394	86.14	19,391,874	15.42
Wet.....	86,492,000	64,865,925	75.00	10,910,235	12.61
Total.....	212,227,000	173,175,319	81.60	30,302,109	14.28
Concrete.....	5,433,300	3,951,876	72.73	1,442,570	26.55
Fill in dams.....	25,043,000	23,025,160	91.94	6,037,735	24.11

The accompanying chart (plate No. 95) shows graphically the excavation, concrete, and fill, and the total expenditures to June 30, 1912, together with the monthly rate of progress of the work and expenditures.

Of the total classified expenditures to June 30, 1912, \$32,547,720.75, or about 12½ per cent, were for plant and equipment for construction and for four steamships, of which amount \$1,254,697.70 were expended during the fiscal year 1912.

TERMINALS.

During the past year considerable progress has been made in connection with the design of terminals at the Atlantic and Pacific entrances of the canal; and consideration has also been given to providing a small permanent dock at Gatun for transferring passengers and freight. The general layout as proposed is based on affording such wharves and piers, of sufficient number and of convenient arrangement, as will be adequate to meet all requirements when the canal is opened, and be readily extended so as to provide for any future increased requirements.

In addition to the berthing space for vessels using the canal and terminal ports, it is proposed to provide the necessary facilities for docking and repairing all classes of vessels, and for furnishing them with fuel, fresh water, and supplies of all kinds. The annual report for 1911 contains the general recommendations on terminals, which were approved in May, 1911, and which were based on filling not only all commercial, but also all canal, naval, and military requirements, it being understood that the facilities will be for the joint use of all vessels requiring them in time of peace, and primarily for naval and military use in time of war.

The general scheme of terminals as outlined in the last annual report has been adhered to, with some comparatively slight modifications which have appeared advisable after further consideration and investigation; and practically all matters which were left unsettled at the beginning of the last fiscal year have since been determined and approved in accordance with the recommendations of various boards representing the different interests concerned therein, as follows:

1. *Main coaling plant.*—The main coaling plant at the Atlantic terminus of the canal will be located on the north end of the island, opposite Dock No. 11 at Cristobal. The capacity of this plant will be as fixed last year and as since approved by the Navy Department. The plant will be capable of handling and storing 200,000 tons of coal, with a possible increase of 50 per cent. Subaqueous storage will be provided for 100,000 tons. This plant will have railroad connection with the mainland over a bascule bridge crossing the French Canal about half a mile south of the entrance to the old Cristobal dry dock, which connection the Panama Railroad Co. is now preparing to make.

2. *Subsidiary coaling plant.*—The subsidiary coaling plant at the Pacific terminus will be located at Balboa, at the outer end of the southeast approach wall of the dry dock, having a frontage of 500 feet thereon especially adapted for discharging vessels, and a front-

age of 500 feet with elevated bunkers adapted for loading vessels and barges farther south on the site now occupied by the Panama Railroad wooden dock. This plant will be capable of handling and storing 100,000 tons of coal, with a possible increase of 50 per cent. Subaqueous storage will be provided for 50,000 tons of coal. The equipment contemplated for this plant includes the four berm cranes which have been used in the construction of the Pacific locks.

3. *Fuel oil supply.*—In addition to coal, facilities will be provided for at Cristobal and at Balboa for supplying shipping and the canal with fuel oil. Arrangements are being made to secure an initial storage capacity of 80,000 barrels at each point by purchasing four tanks of 40,000 barrels' capacity each. These fuel oil plants will be capable of increase as required.

4. *Wharves and piers.*—The wharves and piers for commercial use at Cristobal will be located between Cristobal Point and the canal channel and behind a mole and breakwater built out from Cristobal toward the canal channel and parallel to the new boundary line between the Canal Zone and Panaman waters. All wharves and piers will be of permanent construction. The five piers for which room has been provided will be about 1,000 feet in length and 209 feet wide, with 300-foot slips between. To meet its own commercial requirements the Panama Railroad during the past year has started the construction of one pier with a 300-foot slip on each side; one 1,000-foot wharf, together with the necessary length of mole and breakwater. The head of each slip, for its full length, will be made suitable for the landing and mooring of small boats. The construction of additional piers will be deferred until the necessity therefor develops.

On the Pacific side the piers for commercial use at Balboa will be placed at right angles to the axis of the canal, with the ends of the piers about 2,650 feet from the center of the 500-foot canal channel. The piers will be about 1,000 feet long and 200 feet wide, with 300-foot slips between the piers, and landings for small boats at the head of each slip for the full width between piers. All dimensions accord with those of the Atlantic terminal piers. During the year the width of piers has been increased from 150 feet, as originally planned, to about 200 feet, in order to more fully meet the expected needs. There will be ample room for the construction of five piers should the necessity therefor ever develop. The construction of one pier is to be undertaken at first. In addition to the berthing space thus afforded, there will be the old French steel wharf, about 1,000 feet in length, and also from 2,000 to 3,000 feet of berthing space fronting the shops, which ordinarily may be considered available for commercial use when thus needed.

5. *Superstructure, wharves and piers.*—The superstructure of the commercial piers and wharves will consist of one-story steel sheds having a clear height of 25 feet. To assist in unloading and loading vessels, the sheds will be provided with a horizontal longitudinal girder on each side of the building, elevated to the proper height above the eaves for attaching blocks. The sheds will be of fireproof construction, either reenforced concrete or steel completely incased in concrete. The pier sheds will cover the entire piers except for a space of about 18 feet along each side and the outer end of the pier.

The wharves adjacent to the repair shops at Balboa will not be provided with any sheds. The approved arrangement of tracks on the docks includes a track at the floor level along each edge of piers and wharves. Through the center of the pier sheds there will be two depressed tracks, bringing the car floors level with the floors of sheds.

6. *Cargo handling appliances.*—Considerable study has been given to the convenient and economical handling and storing of freight at the terminals. The opinion is general that after the opening of the canal very little freight will be carried across the Isthmus by rail. The amount of freight that will be handled from ship to ship at the terminals, or requiring storage, and the character of same are at present unknown. The best type of cargo handling appliances can not be determined until these two factors are known. It has been decided therefore that the furnishing at present of any cargo-handling cranes or similar appliances shall be deferred until the future demonstrates that they are essential and also what special type will best meet the conditions. At Cristobal, with a range of tide of scarcely a foot, freight requiring transfer can be easily handled by vessels' cargo booms supplemented by blocks attached to the elevated girders along the sides of the pier sheds. Single pieces too heavy to be thus transferred will be taken care of by a floating crane.

At Balboa, where the average range of tides is close to 13 feet, there will be 8 new electric cranes on the old French wharf and the cranes now in use on this wharf. A floating crane will be available for heavy loads. The transfer of freight from point to point on a pier may be best made by hand or electric trucks. Transfers between piers may be made in standard-gauge cars or by electric trucks. The clear space which has been left along the side of each pier is sufficient to permit the installation of cranes or other appliances should the necessity for same develop in the future.

7. *Docking facilities.*—The main docking facilities have been located at Balboa, which is in accord with the wishes of the Navy Department. There will be one main dry dock capable of accommodating any vessel that can pass through the canal locks. This dock will have a usable length of 1,000 feet, a depth over the keel blocks of 35 feet referred to mean sea level, and an entrance width of 110 feet. The entrance will be closed by miter gates similar to the lock gates. A suitable site has been found under the protection of Sosa Hill. The dock will be founded on rock, and the excavation in the rock will be lined with concrete. Diamond borings taken over the entire area show the rock to be a solid mass of dark fine-grained andesite, which has welled up from the depths of the earth as a core of cooled volcanic rock. The rock indicated by all of the borings is strong, solid, and well suited to give a solid foundation for any structure that may be built upon it. The dry dock will be served by a 40-ton locomotive crane with a travel along both sides.

For smaller classes of vessels an auxiliary dry dock will be provided, for which a suitable foundation on similar hard rock has been found. The latter dock will be in lieu of the marine railways at first contemplated. This dock will have a usable length of 350 feet, a width of entrance of 71 feet at mean sea level, and a depth over the keel blocks of $13\frac{1}{2}$ feet referred to the same level. The auxiliary dry dock will be provided with a floating caisson. The 40-ton locomotive crane will serve the auxiliary dry dock as well as the main dry dock.

On the Atlantic side it is proposed to retain the old French dry dock, which has a width of entrance of 50 feet, a usable length of 300 feet, and a depth over the sill of 13 feet referred to mean sea level. It was the opinion of the board appointed to consider the matter that the commercial requirements now in sight would not warrant the expenditures necessary for the construction of a dry dock at Cristobal capable of taking the largest vessel, in view of the dry dock at Balboa, less than 50 miles away, to which any large vessel on the Atlantic side of the canal requiring to be docked and which would not otherwise have to pass through the canal, could be taken and returned without the payment of canal tolls.

8. *Repair facilities.*—The main repair shops will be built at Balboa within the area between the dry dock and the repair berths and to the northeast of same. They are designed to maintain the following equipment:

- (a) Lock, spillway, and power-plant machinery.
- (b) Water and land equipment retained for the maintenance and operation of the canal.
- (c) Rolling stock and equipment of the Panama Railroad.
- (d) Mechanical apparatus connected with the coaling plants, fortifications, cold-storage plant, wireless stations, etc.
- (e) The making of such repairs, etc., as may be required by private parties and corporations on the Isthmus.
- (f) The making of repairs, etc., required by commercial vessels.
- (g) The making of such repairs as may be required by vessels of the United States Navy and vessels belonging to other Governments.

The main metal-working shops, including machine shop, erecting and tool shops, the forge shop, and the boiler and ship fitters' shop, together with the shed for the storage of steel, have been placed end on between the dry dock and repair berths. The general storehouse, foundry, woodworking shops, subsidiary buildings, and office building have been placed parallel to the line of the dry dock and water front and northeast of the main shops. Two lines of railroad tracks run past each end of the main metal-working shops, and one track through the center of same. The main shops will be provided with overhead traveling cranes, the crane runways being extended through each end of the buildings over the railroad track. Material brought out of the southeast end of the main shops by the overhead cranes can be handled directly into the dry dock by the 40-ton crane, or loaded into cars. The arrangement aimed at has been to secure the most economical handling of material and work to and from the shops. So far as possible machines now in use will be installed in the new shops, which will be electric driven, both individual and group drive being used. The floor area of the principal buildings is as follows:

Building:	Floor area (square feet).
(a) Machine, erecting, and tool shops_____	67,420
(b) Forge, pipefitters', tinsmiths', and copper shop__	31,650
(c) Steel storage shed_____	18,080
(d) Boiler and shopfitters' shop_____	45,940
(e) General storehouse _____	89,920
(f) Paint shop_____	12,760
(g) Car shop _____	38,800

Building—Continued.	Floor area (square feet).
(h) Joiner, carpenter, and pattern shop-----	48, 240
(i) Galvanizing shop-----	5, 620
(j) Lumber and equipment store shed-----	67, 060
(k) Steel, iron, and brass foundry-----	37, 060
(l) Coke shed-----	3, 070
(m) Boiler house-----	2, 380
(n) Pattern storage building-----	13, 870
(o) Office building-----	9, 500
Total-----	491, 370

There will be a number of subsidiary buildings the dimensions of which have not yet been determined. These buildings are being designed as modern shops of permanent construction, with steel frames. The roofing will be of permanent character. The sides and ends will be left open for ventilation and light, protection from sun and rain being afforded by overhanging sheds.

Until future requirements are more definitely developed, it is proposed to retain existing shop facilities of moderate extent for emergency repairs, in the vicinity of the old French dry dock at Cristobal.

The flooding of Gorgona shops by the rising waters of Gatun Lake about July 1, 1913, will render it necessary to make the new buildings ready for occupancy at that time.

9. Floating equipment.—For the expeditious and convenient handling of lock gate leaves, as well as for commercial and other canal needs and general wrecking purposes, it will be necessary to provide a floating crane of the largest practicable capacity at each terminus of the canal. An investigation is now under way to determine the best way in which these requirements can be filled, with a view to purchasing two floating cranes.

For handling vessels of the largest size at Cristobal and at Balboa, harbor tugs of high power will be required, and the tugs now owned by the commission will not be satisfactory or economical for this service. It is proposed to provide two large harbor tugs at each terminus of the canal for this purpose.

As a great deal of coal may be expected to be furnished to shipping in barges or lighters that can be laid alongside vessels, it will be necessary to equip the canal with a sufficient number of barges, as well as fuel, oil, and fresh-water lighters. It is expected that a large number of steel barges of large capacity, which have been used by the commission on construction work, will be available for transfer to this service. A barge capacity of 16,000 tons of coal has been recommended by the Navy Department for the Atlantic terminus and 8,000 tons at the Pacific terminus.

If the canal business warrants it, a tender for passengers and mail will be provided at each terminus.

During the past year work has been proceeding on the general and detailed plans of terminals, with a view to starting work as soon as it is authorized and appropriations become available. In anticipation of favorable legislation, at the latter part of the year some preliminary work was undertaken, in order not to lose time and to keep the plant and organization employed, including grading and dredging at Balboa.

10. Permanent settlements.—During the past year the locations of the permanent administration building and canal headquarters and

the permanent settlements for employees have been determined after investigation and consideration by committees representing the different interests concerned. The permanent administration building, as approved May 24, 1912, will be on a knoll west of Ancon quarry and immediately east of the railroad track leading to Ancon quarry, where it will overlook both the terminal piers and the canal entrance. The quarters for employees attached to the administration building will be erected in the general area adjacent to and northeast of the administration building. Employees connected with the shops, docks, and other terminal facilities will be housed in quarters erected in the area surrounding the slope of Sosa Hill and on the fill adjoining the Ancon-Balboa highway.

There will be a permanent settlement at Pedro Miguel for employees of the Pacific locks, and one at Gatun for employees of the Atlantic locks. The settlement at Cristobal will be maintained and possibly the settlement at Ancon. No necessity is apparent for any other than the above five settlements, except for the military forces which may be stationed on the Isthmus.

11. Leases of land for commercial purposes.—During the past year a number of applications have been received from individuals and companies for leases of lands in the vicinity of the Atlantic and Pacific terminals for use in storing and supplying coal, fuel oil, general supplies, etc., to shipping. Of lands owned by the United States, existing law limits leases to actual settlers for agricultural purposes. The only way in which these applications can, therefore, be given favorable consideration until additional legislation is secured is to grant revocable licenses for the use of any lands that may be spared for these purposes. This arrangement is not a contract, and in the event of the licensee having to vacate the lands he would have no claim against the Government for any improvements. In order that information may be available on this matter, an investigation is now being made by a committee appointed to consider, among other matters, the areas of land and water frontage at Cristobal, Balboa, and vicinity which shall be considered available for license or lease to individuals or companies.

METEOROLOGICAL AND HYDROGRAPHIC SECTION.

GENERAL.

Three first-class meteorological stations are maintained—Ancon, Culebra, and Colon—each with full complement of instruments and in charge of a skilled observer. There are two second-class stations—Gatun and Pedro Miguel—at which wind direction and velocity, temperature, and rainfall are recorded. Twenty-six rainfall stations are in operation, 15 equipped with standard and 11 with automatic rain gauges.

At Miraflores an anemometer is maintained at the request of the department of sanitation, the data being used for the study of mosquito flight in that locality. On Sosa Low an anemometer is also maintained for comparative purposes with Ancon.

Evaporation stations are in operation at Ancon, Rio Grande Reservoir, Gatun Lake, Brazos Brook Reservoir, and Colon. Two 100-kilogram Bosch-Omori seismographs are in operation at Ancon,

and two 25-kilogram Bosch-Omori seismographs are in operation on Guarapo Island near Gatun.

Duplicate automatic tide registers are located on Dock No. 1, Colon, and two on the Panama Railroad dock, Balboa.

The automatic record of sea temperature has been continued at Colon and Balboa.

Ocean meteorological data have been received from vessels arriving at the ports of Ancon and Cristobal, and every assistance is rendered the masters of these ship in adjusting and correcting their instruments.

Gauging stations have been maintained during the year on the Chagres River at Gatun, Gamboa, and Alhajuela. Gauging work on the Gatun River was carried on to a limited extent only, on account of the backwater of the level above the Panama Railroad embankment. Regular work was continued on the Trinidad River by the gauging of the Trinidad branch and Siri River after the backwater of Gatun Lake was felt at gauging station on the main river. The backwater conditions at Bohio led to the abandonment of the station for gauging work.

Automatic water-stage registers were in operation above and below the Spillway at Gatun and on the Chagres River at Bohio, Gamboa, Alhajuela, and Vigia. An instrument has been in operation at Frijoles since April 5, 1912. The automatic registers on the Trinidad and Pedro Miguel Rivers continued in operation throughout the year at the old locations. Continuous records on the Rio Grande River above the reservoir were kept until April 30, 1912, when the instrument was removed. Weekly gaugings were made by the field hydrographer on small streams flowing into Gatun and Miraflores Lakes.

The meteorological office at Cristobal was moved August 24, 1911, from House No. 1 to the general office building, Panama Railroad, Colon, and duplicate tide registers from Dock No. 13 to Dock No. 1, Colon.

Owing to the continued extension of the sand bar in front of the old French fluviograph and water-stage register at Gamboa, the latter instrument was removed to the site of the present cable station.

The anemometer at Gamboa was removed on January 16, 1912.

The rainfall and river stations at San Pablo and Tabernilla were respectively, discontinued on January 15 and 17, owing to completion of construction work at these localities.

The gauging, rainfall, and current observations at Bohio were discontinued on January 18, 1912.

The semimonthly rain gauges on the Cabimba and Caño Rivers were discontinued on January 31, 1912.

The recording of air temperatures at Rio Grande and Brazos Brook Reservoirs was discontinued, as the records were practically duplicates of the Culebra and Colon records.

The rain gauges at Chorrera and Chepo were discontinued on February 29, 1912.

Seasonal rain gauges were established on the Rio Indio, Culebra, Caño, and upper Trinidad Rivers to facilitate the study of rainfall and run-off over the Chagres Drainage Basin. Maximum gauge staffs were set on the lower Rio Grande, Pedro Miguel, Cocoli, Mandingo, Frijoles, Frijoles Grande, Agua Salud, and Gatun Rivers to facilitate the calculation of the run-off from these streams during freshet periods.

A rainfall station was established and water-stage register installed at New Frijoles to replace those formerly at Bohio, San Pablo, and Tabernilla, and placed in charge of a foreman.

A new current meter-rating station was established near Gamboa to replace the one formerly at Bohio. This station is equipped with modern appliances, which greatly facilitate the work.

Watchman's quarters were erected on the Siri at Las Aricas to replace the quarters abandoned on the Trinidad at Las Cruces, caused by the backwater in Gatun Lake.

The bench marks at all river stations and the zero of the Colon and Balboa tide registers were checked at regular intervals, and when necessary corrections were applied to the records.

The telephone line from Gamboa to Vigia was "looped" to connect Calle Larga gauging station, which greatly facilitates the work at this station during flood periods.

METEOROLOGY.

WEATHER.

The weather for the calendar year 1911, as a whole, was characterized by a general deficiency in rainfall, relative humidity, cloudiness, and atmospheric pressure, and an excess in temperature and wind movement. The abnormally light rainfall and high temperatures experienced during 1911 continued throughout the dry season of 1912.

PRECIPITATION.

Rainfall in the Canal Zone during 1911 was well below normal at all stations, being the lightest of record at Gamboa, Bohio, and at several of the stations for which only a few years' records are available. The deficiencies ranged from 10 per cent at Balboa to 41 per cent at Bohio. The dry-season rainfall amounted to 12 per cent of the annual total in the Pacific section, and 8 and 9 per cent, respectively, in the Central and the Atlantic sections. Monthly rainfall records for 1911, 1912, and the station averages are shown in Table No. 1. The following table presents the average rainfall and average number of rainy days, by sections, for the year 1911:

Section.	Average rainfall, year 1911.	Number of rainy days, 1911.
	<i>Inches.</i>	
Pacific.....	67.21	172
Central.....	79.10	214
Atlantic.....	116.45	265

Of the stations in the Canal Zone, Balboa reported the least number of rainy days—158, and Monte Lirio the greatest number—304. The average monthly rainfall records for the various sections are shown in Table No. 2. The heaviest precipitation of the year occurred at Porto Bello on November 29. During this storm 7.60 inches of rain fell in 12 hours, and the maximum fall for five minutes amounted to approximately 2.48 inches. The automatic record was indistinct, due to the extremely excessive rate of fall, but the amount

as stated above is thought to be approximately correct, and as careful investigation failed to disclose probability of error in the record it was accepted as authentic. Rainfall on the Isthmus was everywhere deficient during the dry season of 1911-12, which continued from December 1, 1911, to about May 7, 1912, and was the driest period of which there is any record on the Isthmus. The total rainfall at Alhajuela during this period of five consecutive months (December to April inclusive) amounted to only 1.02 inches and the average fall over the Isthmus amounted to less than 30 per cent of the normal December to April precipitation. The maximum rainfall of record for periods of 5 minutes, 1 hour, and 24 hours, at stations equipped with automatic registers, is shown in Table No. 3, while Table No. 4 presents the hourly distribution of rainfall in the Canal Zone during the year 1911.

TEMPERATURE.

Average temperatures for the year 1911 were generally above normal. July was the warmest month at Ancon and Culebra, and December at Colon. The highest temperature recorded during the calendar year 1911 was 95° F. at Ancon, on October 16. The lowest was 65° F. at Culebra, on March 27.

Average temperatures continued abnormally high during the first six months of 1912. All previous maximum temperature records were exceeded at Ancon and Culebra during the month of April, 1912. The maximum reading at Ancon on April 7—97° F.—established a new high temperature record for the continental area of the Canal Zone. The following table shows the absolute maximum and minimum temperatures of record at the three meteorological stations:

Absolute temperatures of record.

[Revised to June 30, 1912.]

Station.	Maximum.		Minimum.	
	° F.	Date.	° F.	Date.
Ancon.....	97	Apr. 7, 1912	63	Jan. 27, 1910
Culebra.....	96	Apr. 17, 1912	61	Mar. 21, 1910
Colon.....	92	June 3, 1909	66	Dec. 3, 1909

NOTE.—The lowest temperature of record on the Isthmus is 59° F., observed at Bas Obispo on February 9, 1907. The maximum temperature record at Ancon—97° F.—was equaled at the Naos Island station on February 13, 1906.

Monthly temperature records and other weather data for the year 1911 are presented in Tables Nos. 5, 6, and 7.

WIND.

There was a moderate excess in wind movement at the various stations during 1911. The prevailing direction was from the northwest at Ancon and Culebra and from the north at Colon. The highest average velocities occurred during February and March and the lowest during October and November. The records for the first six

months of 1912 show a notable excess in wind movement at each station. Steady northerly winds prevailed generally over the Isthmus, and the percentage of variable wind was unusually low. The following table, revised to June 30, 1912, shows the maximum velocities of record at the first-class stations:

Maximum velocities (5 minute periods).

Station.	Miles per hour.	Direction.	Date.
Ancon.....	59	South.....	July 10, 1909
Culebra.....	39	North.....	July 20, 1910
Colon.....	40	South.....	July 16, 1908

ATMOSPHERIC PRESSURE.

The annual mean atmospheric pressure for 1911 was the lowest recorded in the Canal Zone during the past six years. The extreme range in pressure during the year was unusually wide. Both the maximum and the minimum observed pressures of record in the Canal Zone occurred in 1911. March was the month of highest mean pressure and December the month of lowest pressure.

RELATIVE HUMIDITY.

The relative humidity was generally below normal during the year 1911 and the first half of 1912. The mean for 1911 (from bihourly readings) was 81 per cent at Ancon and 84 per cent at Culebra and Colon. The highest monthly averages occurred in November and the lowest in March.

CLOUDINESS.

Cloudiness was generally deficient during 1911 and the first six months of 1912. January was the month of minimum average cloudiness in the Canal Zone and June the month of maximum cloudiness.

EVAPORATION.

Weather conditions during 1911 favored a high rate of evaporation, and the totals recorded during the year were the highest of record at all stations. The rate of evaporation during the dry season was nearly double the rate during the rainy season. Evaporation during the first half of 1912 continued abnormally heavy. Monthly records for each station are shown in Table No. 8.

Three floating evaporation pans were installed at selected locations on Gatun Lake for the purpose of determining the relative rates of evaporation over open sections of the lake and along the grass and timber protected margins. In establishing these stations the aim was to obtain conditions in and surrounding the pans as nearly as possible approximating the conditions that will prevail over the diversified surface of Gatun Lake when the latter is filled to the elevation required for operating the canal. One pan was anchored in the open

section south of the spillway well out toward the center of the present lake area. The second pan was located in the timber fringe bordering the southern shore, and the third in an extensive patch of tall marsh grass toward the south side of the lake. Records were begun in May, 1911, and continued for a period of six months. The results obtained are considered roughly accurate. The rate of evaporation from the pan in the open section of the lake was found to be materially higher than the rates from the pans located along the lake margin, where dense vegetation decreases the evaporation by retarding the wind movement and shading the surface of the water. The following is a statement of the average evaporation at the three locations, expressed in percentage of evaporation from the exposed pan:

	Per cent.
Pan in exposed section of lake-----	100
Pan in timber fringe-----	72
Pan in marsh grass-----	75

FOGS.

Night fogginess was of frequent occurrence at interior points in the Canal Zone during the year 1911. The greatest number of foggy nights occurred in Culebra, Bas Obispo, and Bohio. Practically all fogs lifted or were dissipated by 8.30 a. m. The record of the number and duration of fogs observed at the various stations during 1911 is shown in Table No. 9.

SEA TEMPERATURE.

The average surface temperatures of the sea water at Balboa and Colon were slightly above normal during the year 1911. The annual mean was 81° F. at Balboa and 82° F. at Colon. The minimum recorded during the year was 66° F. at Balboa in March and the maximum 87° F. at Colon in August. The monthly means and extremes at each station are shown in Table No. 10.

TIDE RECORDS.

A tide register was installed at Corozal in February, 1911, and continued in operation until June 1, 1912. Tidal records were obtained at this station for comparison with the Balboa records. There was found to be practically no difference in mean sea level at the two stations, but the daily tidal range averages from 0.1 foot to 0.2 foot greater at Corozal than at Balboa. The tidal extremes of record at Balboa and Colon are given below:

Station.	Maximum high water.		Extreme low water.		Maximum daily range. ¹		Minimum daily range. ¹	
	Elevation.	Date.	Elevation.	Date.	Feet.	Date.	Feet.	Date.
Balboa....	+11.2	Oct. 2, 1909	-10.6	Apr. 11, 1910	20.8	Apr. 11, 1910	5.1	Mar. 24, 1911
Colon.....	+ 1.65	Nov. 27, 1909	- 1.01	June 9, 1910	2.17	June 28, 1911	(²)	

¹ For consecutive tides.

² One tidal fluctuation often entirely absent at Colon. Elevations in feet referred to mean sea level.

Tide conditions on the Atlantic and Pacific coasts for the year 1911 are shown in Table No. 11.

SEISMOLOGY.

The seismographs at Ancon and Gatun registered a considerable number of seismic disturbances during the fiscal year 1911-12. Many of these disturbances were slight tremors due to quakes of distant origin. Few were shocks of sufficient intensity to be sensibly felt in the Canal Zone, and no damage resulted from any of them. The more important shocks recorded at Ancon were as follows:

Date.	Maximum amplitude.	Remarks.
	<i>Millime- ters.</i>	
Oct. 10, 1911.....	43	Distance of epicenter about 400 miles.
Dec. 23, 1911.....	24	
Apr. 17, 1912.....	68	Record incomplete; pen passed from sheet.

The shock of April 17 was generally felt over the Isthmus. Its epicenter was approximately 225 miles distant from Ancon. The direction could not be determined from the record. A complete list of the seismic disturbances recorded at Ancon during the year is presented in Table No. 12. The records at Gatun agree in most respects with the Ancon records.

The following plates and tables accompany the report of the meteorological section:

- Plate 98. Annual rainfall along canal location.
- Plate 99. Wind roses, year 1911, dry and rainy seasons.
- Table 1. Monthly rainfall on the Isthmus of Panama.
- Table 2. Monthly rainfall by sections, year 1911, and normal.
- Table 3. Maximum rainfall in Canal Zone.
- Table 4. Hourly distribution of rainfall in Canal Zone.
- Table 5. Monthly meteorological data, Ancon, year 1911.
- Table 6. Monthly meteorological data, Culebra, year 1911.
- Table 7. Monthly meteorological data, Colon, year 1911.
- Table 8. Monthly evaporation, Canal Zone, 1911, 1912, and averages.
- Table 9. Fogs along the canal prism, year 1911.
- Table 10. Sea temperatures, year 1911.
- Table 11. Tidal conditions, year 1911.
- Table 12. Seismograph records, Ancon, year ended June 30, 1912.

TABLE NO. 1.—*Monthly rainfall on the Isthmus of Panama, 1911-12, and station averages.*

[Values in inches.]

Station.	January.	Febru- ary.	March.	April.	May.	June.	July.	August.	Septem- ber.	October.	Novem- ber.	Decem- ber.	Annual.
Ancon:													
1911.....	0.83	2.75	0.26	6.34	11.04	3.40	5.78	7.21	6.03	10.90	7.57	1.99	64.10
1912.....	T.	.08	.01	2.68	10.71	5.80	8.02	7.61	7.39	10.46	10.72	4.24	71.23
Average for 14 years.....	1.10	.91	.84	2.77	8.85	8.32							
Balboa:													
1911.....	.38	3.22	.00	7.39	8.85	4.23	7.12	8.50	8.66	8.47	5.55	1.36	63.73
1912.....	.00	.18	.00	2.88	9.56	5.88							
Average for 13 years.....	1.21	.60	.91	4.19	7.06	8.09	9.88	7.61	6.54	9.07	9.32	6.05	70.53
Miraflores:													
1911.....	.27	2.43	.00	2.86	10.16	3.71	6.83	7.06	8.30	9.71	9.24	1.40	61.97
1912.....	.00	.34	.00	4.79	7.60	7.51	9.47	8.50	9.90	12.37	12.31	8.51	92.18
Average for 3 years.....	2.68	2.09	1.20	3.44	9.77	11.94							
Pedro Miguel:													
1911.....	.03	1.40	.03	5.24	9.57	5.52	6.36	5.43	8.31	12.92	7.49	1.82	64.12
1912.....	.00	.22	.03	4.23	6.92	9.69	8.51	8.72	8.44	13.06	11.64	8.25	87.13
Average for 4 years.....	1.24	1.29	.54	3.47	11.51	10.46							
Rio Grande:													
1911.....	.02	.91	.06	6.86	16.89	4.03	7.00	8.17	6.63	16.65	13.62	1.27	82.11
1912.....	.03	.33	.03	3.03	7.18	6.63	11.31	9.93	10.62	13.62	11.71	6.20	90.78
Average for 7 years.....	1.53	.72	.37	3.59	11.45	9.73							
Culebra:													
1911.....	.02	.74	.06	4.89	14.86	4.25	5.95	8.36	5.97	17.06	12.37	.31	74.84
1912.....	.05	.33	.02	3.14	8.15	7.57	9.50	10.46	11.09	11.60	12.51	7.81	90.14
Average for 21 years.....	1.83	.57	.71	3.83	11.31	8.92							
Camacho:													
1911.....	.04	.69	.13	6.98	18.11	4.62	6.62	7.98	6.97	18.81	12.43	1.34	84.72
1912.....	.04	.65	.06	2.44	6.15	7.77	10.87	9.87	10.60	14.56	14.32	7.17	97.10
Average for 5 years.....	1.43	.85	.68	3.74	12.43	10.58							
Empire:													
1911.....	.02	.55	.20	3.93	13.74	5.92	4.00	5.98	5.46	14.97	11.73	.20	66.70
1912.....	.01	.34	.01	2.64	6.21	8.50	9.35	9.62	7.62	14.28	11.52	5.81	82.18
Average for 7 years.....	.85	.58	.50	3.69	10.12	8.24							
Gamboa:													
1911.....	.11	.71	.38	4.01	14.53	6.98	7.26	7.68	5.20	12.75	10.09	.97	70.67
1912.....	.06	1.11	.10	.77	7.94	11.64	10.32	12.04	10.42	12.77	12.46	7.09	92.98
Average for 29 years.....	1.91	.84	.86	3.63	11.01	9.63							
Alhajuela:													
1911.....	.14	2.29	.01	4.88	* 16.11	10.53	8.84	10.79	9.29	13.39	13.39	.39	90.05
1912.....	.08	.33	.02	.20	13.43	12.17	13.47	13.10	11.79	13.52	14.60	7.45	105.88
Average for 12 years.....	1.33	.83	.71	3.47	12.69	12.92							

El Vigia:													
1911.....	.20	3.19	.04	3.40	10.62	12.11	8.76	12.56	7.64	14.13	9.54	.45	82.64
1912.....	.08	.62	.08	.37	12.81	14.51							
Average for 3 years.....	1.60	3.49	1.10	2.68	12.21	13.69	12.67	12.94	13.45	16.44	17.86	7.76	115.89
Gorgona:													
1911.....	.43	1.99	.36	3.16	17.56	7.21	6.45	8.51	6.41	13.19	10.23	1.01	76.51
1912.....	.20	.35	.02	.71	8.03	14.82							
Average for 7 years.....	2.09	.93	1.14	3.18	12.96	8.76	11.30	11.88	12.42	13.11	13.85	7.35	98.97
Bahio¹:													
1911.....	.32	1.87	.97	4.87	12.32	6.96	7.29	5.69	5.30	13.24	17.01	1.34	77.18
Average for 17 years.....	6.00	2.11	2.01	5.78	13.84	12.14	13.01	14.77	13.53	16.60	19.26	10.67	129.72
Frijoles:													
1912.....	.67	3.01	.10	1.19	10.28	13.25							
Trinidad:													
1911.....	.64	2.00	2.33	3.33	18.20	8.79	3.63	8.17	7.03	15.56	18.76	3.09	91.53
1912.....	1.38	1.15	.28	3.03	11.79	11.80	8.94	12.18	12.41	14.76	22.30	12.61	125.46
Average for 4 years.....	3.80	3.28	3.89	5.74	14.65	10.90							
Monte Lirio:													
1911.....	.89	2.41	1.41	5.27	19.70	11.43	10.58	9.58	11.19	18.46	20.05	2.30	113.27
1912.....	2.14	3.32	.24	1.29	8.34	13.51							
Average for 4 years.....	3.98	4.60	4.64	5.77	15.84	13.64	14.76	11.88	12.79	15.46	26.49	12.26	142.11
Gatun:													
1911.....	1.20	2.19	1.80	6.38	19.14	14.72	6.66	7.91	4.33	16.92	15.78	2.25	99.28
1912.....	.91	2.38	.55	4.18	13.83	14.80							
Average for 7 years.....	4.24	2.41	8.25	4.03	15.93	13.61	12.51	14.73	9.97	16.91	22.85	13.89	134.33
Brazos Brook:													
1911.....	1.00	2.03	1.30	3.90	19.92	16.10	14.04	12.19	10.32	14.56	18.86	1.86	116.08
1912.....	.61	2.26	.53	.85	11.45	19.12							
Average for 5 years.....	4.10	2.31	3.78	3.62	13.52	15.24	16.88	14.73	11.98	14.73	25.16	14.95	141.00
Colon:													
1911.....	.99	1.81	1.41	3.06	17.13	15.58	14.58	11.60	11.62	16.53	15.81	2.63	112.75
1912.....	.28	1.81	.66	.75	12.03	15.90	16.46	15.13	12.54	14.20	21.86	12.33	129.59
Average for 41 years.....	4.05	1.46	1.69	4.16	12.42	13.29							
Porto Bello:													
1911.....	.84	6.90	2.38	6.60	19.25	18.04	14.48	22.56	17.55	13.78	24.40	2.16	148.94
1912.....	.67	1.64	.60	.54	16.65	19.77	18.40	18.52	13.32	9.82	30.36	24.49	173.02
Average for 4 years.....	9.64	5.28	3.30	8.07	14.82	17.00							

¹ Rainfall station moved from Bohio to Frijoles in January, 1912, on account of projected rise in Gatun Lake.

NOTE.—Monthly averages do not include the year 1912.

TABLE NO. 2.—*Monthly rainfall by sections, year 1911 and normals.*

[Values in inches.]

Month.	Pacific section.		Central section.		Atlantic section.	
	1911	Normal.	1911	Normal.	1911	Normal.
January.....	0.31	1.55	0.28	2.39	1.11	6.36
February.....	2.14	1.12	1.55	1.76	3.24	3.38
March.....	.07	.77	.59	1.64	1.59	2.65
April.....	5.74	3.49	4.43	4.27	5.16	5.78
May.....	11.30	9.73	14.71	12.36	18.44	13.82
June.....	4.18	9.71	7.42	10.68	15.42	14.90
July.....	6.62	9.44	6.59	11.19	11.77	15.73
August.....	7.27	8.47	8.41	11.60	13.19	14.85
September.....	7.59	8.58	6.56	11.62	11.22	11.36
October.....	11.73	11.72	14.25	14.54	14.38	13.39
November.....	8.69	11.14	13.24	16.26	¹ 18.71	¹ 25.05
December.....	1.57	6.65	1.05	8.50	¹ 2.22	¹ 16.42
Year.....	67.21	82.37	79.08	106.81	116.45	143.69

¹ Mean of 4 stations. No record at Nombre de Dios.

NOTE.—Averages in Pacific section are based on the records from 5 stations; in central section, 12 stations; and in Atlantic section 5 stations. All available records are used in computing normals.

TABLE NO. 3.—*Maximum rainfall in Canal Zone, Oct. 1, 1905, to June 30, 1912.*

Stations.	Maximum rainfall.					
	5 minutes.		1 hour.		24 hours. ¹	
	Inches.	Date.	Inches.	Date.	Inches.	Date.
Ancon (Oct. 1, 1905)...	0.64	Aug. 7, 1908	3.98	Oct. 9, 1911	7.23	May 12-13, 1911.
Balboa (June 10, 1906)...	.90	May 12, 1912	5.86	June 2, 1906	7.57	Nov. 16-17, 1906.
Pedro Miguel (Jan. 1, 1908).	.60	Nov. 11, 1908	3.30	Aug. 27, 1908	4.56	Sept. 30-Oct. 1, 1909.
Rio Grande (Dec. 29, 1905).	.75	July 24, 1908	2.74	Apr. 25, 1911	6.00	Dec. 2-3, 1906.
Culebra (July 1, 1906)...	.64	May 2, 1908	3.69	Oct. 16, 1907	5.55	Dec. 3, 1906. ²
Empire (July 18, 1906)...	.60	July 25, 1906	3.63	Oct. 1, 1909	6.15	Do. ²
Gamboa (Nov. 18, 1905).	.59	July 27, 1908	3.32	May 11, 1911	6.56	Dec. 2-3, 1906.
Alhajuela (Mar. 31, 1907).	.60	July 20, 1909	3.40	Dec. 28, 1909	8.19	Dec. 3, 1906. ²
Bohio ³ (Oct. 1, 1905)...	.67	June 16, 1909	4.51	Aug. 7, 1908	8.85	Aug. 7-8, 1908.
Gatun (Aug. 24, 1907)...	.61	July 16, 1908	3.82	May 26, 1910	10.48	Dec. 3, 1906. ²
Colon (Oct. 1, 1905)....	.64	Aug. 25, 1909	4.90	Oct. 8, 1909	8.53	Dec. 2-3, 1906.
Porto Bello (May 1, 1908).	⁴ 2.48	Nov. 29, 1911	4.53	Nov. 29, 1911	10.86	Dec. 28-29, 1909.

¹ Maximum fall for any 24 consecutive hours.² No automatic record on this date. Total for 24 hours ending at noon.³ Rainfall record at this station discontinued January, 1912.⁴ Approximate. Automatic record indistinct, due to unusually excessive rate of fall.

NOTE.—Dates in parentheses under station names refer to installation of automatic rainfall registers.

TABLE NO. 4.—*Hourly distribution of rainfall in Canal Zone, year 1911.*

[Values in inches.]

Stations.	Total annual rainfall.	Rainfall during working hours. 7 a. m. to 5 p. m.		Hourly rainfall.			
				Maximum.		Minimum.	
		Amount.	Per cent of total.	Hour of maximum.	Accumulated amount.	Hour of minimum.	Accumulated amount.
Balboa.....	63.73	48.36	76	3-4 p. m.	12.25	12-1 a. m.	0.33
Pedro Miguel.....	64.12	55.88	87	1-2 p. m.	13.19	1-2 a. m.	.07
Rio Grande.....	82.11	72.25	88	2-3 p. m.	19.78	12-1 a. m.	.09
Culebra.....	74.84	65.05	87	2-3 p. m.	17.59	11-12 p. m.	.09
Empire.....	66.70	57.77	87	2-3 p. m.	17.01	10-11 p. m.	.06
Gamboa.....	70.67	60.66	86	1-2 p. m.	18.09	9-10 p. m.	.15
Alhajuela.....	90.05	73.22	81	1-2 p. m.	22.38	12-1 a. m.	.04
Tabernilla.....	62.51	49.84	80	1-2 p. m.	11.01	10-11 p. m.	.19
Bohio.....	77.18	50.06	65	2-3 p. m.	11.53	11-12 p. m.	.55
Gatun.....	99.28	52.01	52	2-3 p. m.	11.06	12-1 a. m.	2.16
Coion.....	112.75	55.25	49	2-3 p. m.	11.88	12-1 p. m.	1.45

TABLE No. 5.—*Monthly meteorological data, Ancon, Canal Zone, year 1911.*

Month.	Atmospheric pressure (inches).		Air temperature (degrees Fahrenheit).								Mean wet thermometer.		Mean temperature, dew point.	Mean relative humidity (per cent).	Precipitation (inches).			Wind.					Number of days.				Average cloudiness.
	Station.	Sea level.	Mean.	Maximum.	Day.	Mean maximum.	Minimum.	Day.	Mean minimum.	Maximum daily range.	Mean wet thermometer.		Mean temperature, dew point.	Mean relative humidity (per cent).	Total.	Normal. ¹	Rainy days.	Total movement (miles).	Prevailing direction.	Miles per hour.	Direction.	Maximum velocity.	Clear.	Part cloudy.	Cloudy.	Thunderstorms.	
January.....	29.762	29.858	79.8	91	4	89	66	8	70	23	71	72	69	82	0.83	1.10	7	6,457	NW.	22	N.	9	8	23	0	0	4.4
February.....	29.754	29.850	79.8	91	1	89	68	2	71	22	72	70	70	83	2.75	.91	9	5,915	NW.	26	N.	22	3	12	13	4	6.9
March.....	29.808	29.905	80.0	93	24	91	65	11	69	25	70	68	68	76	.26	.84	2	7,143	NW.	24	N.	3	2	27	2	0	5.5
April.....	29.732	29.827	81.2	94	23	89	71	7	73	21	75	73	73	84	6.34	2.77	17	5,653	NW.	24	N.	11	0	9	9	9	8.2
May.....	29.740	29.835	79.1	92	30	86	69	8	72	19	75	74	74	89	11.04	8.85	25	3,872	SE.	23	SE.	10	1	11	19	19	8.0
June.....	29.739	29.834	80.0	94	20	87	71	10	73	22	76	75	75	91	3.40	8.32	16	4,235	NW.	20	W.	30	0	9	21	19	8.0
July.....	29.724	29.819	82.2	94	20	91	71	30	74	23	76	76	75	88	5.78	8.02	17	5,692	NW.	25	E.	23	0	19	10	18	6.2
August.....	29.711	29.806	80.6	92	7	88	70	12	73	22	76	75	75	92	7.21	7.61	19	4,880	NW.	19	N.	18	0	14	17	23	7.5
September....	29.710	29.806	80.8	93	13	89	68	22	73	21	76	75	75	90	6.03	7.39	14	4,712	NW.	25	NE.	22	0	20	10	24	6.7
October.....	29.732	29.828	80.0	95	16	88	69	19	72	20	75	75	75	94	10.90	10.46	17	4,797	NW.	38	SE.	3	1	12	18	22	7.3
November....	29.728	29.824	79.4	94	27	87	68	14	72	21	75	75	75	92	7.57	10.72	20	3,997	NW.	19	S.	15	5	22	3	15	5.0
December....	29.694	29.789	81.0	94	21	90	69	14	72	23	74	73	73	85	1.99	4.24	7	5,993	NW.	21	N.	2	8	19	4	1	4.7
Year.....	29.720	29.832	80.3	95	216	88.7	65	311	72	25	74.2	73.1	73.1	87.3	64.10	71.23	170	63,346	NW.	38	SE.	43	30	197	138	154	6.5

¹ October.

² March.

³ October.

⁴ Mean of 14 years' record.

TABLE No. 6.—*Monthly meteorological data, Culebra, Canal Zone, year 1911.*

Month.	Atmospheric pressure (inches).		Air temperature (degrees Fahrenheit).							Mean wet thermometer.		Mean temperature, dew point.	Mean relative humidity (per cent).	Precipitation (inches).			Wind.					Number of days.				Average cloudiness.
	Station.	Sea level.	Mean.	Maximum.	Day.	Mean maximum.	Minimum.	Day.	Mean minimum.	Maximum daily range.	Mean wet thermometer.		Mean relative humidity (per cent).	Total.	Normal. ¹	Rainy days.	Total movement (miles).	Prevailing direction.	Miles per hour.	Direction.	Day.	Clear.	Part cloudy.	Cloudy.	Thunderstorms.	
January.....	29.454	29.869	77.8	89	15	86	66	8	69	20	71	69	85	0.02	1.83	2	7,395	N. W.	28	N.	12	14	17	0	0	3.8
February....	29.447	29.861	78.0	88	11	86	66	3	71	21	71	70	85	.74	.57	7	6,836	N. W.	33	N.	27	16	15	7	3	5.6
March.....	29.504	29.919	78.0	91	31	88	65	27	68	25	70	68	80	.06	.71	1	8,051	N. W.	30	N.	17	7	23	1	0	4.5
April.....	29.426	29.838	80.2	92	29	88	69	1	73	22	74	72	86	4.89	3.83	14	6,450	N. W.	31	N.	15	0	13	17	7	7.5
May.....	29.426	29.838	79.2	92	7	86	70	12	72	21	74	73	92	14.86	11.31	22	3,505	N. W.	23	E.	18	0	11	20	22	7.8
June.....	29.426	29.838	79.4	91	26	86	71	24	73	19	75	74	93	4.25	8.92	22	3,802	N. W.	28	N. E.	24	0	7	23	21	8.3
July.....	29.418	29.829	80.8	92	20	88	70	30	73	20	75	74	90	5.95	9.50	18	5,912	N. W.	25	N. E.	23	1	15	15	18	7.0
August.....	29.404	29.816	79.8	91	7	87	70	12	73	19	74	74	93	8.36	10.46	27	4,759	N. W.	38	N. E.	18	0	15	16	20	7.6
September..	29.405	29.817	79.9	91	27	87	70	22	73	19	75	74	92	5.97	11.09	20	4,389	N. W.	29	N. E.	30	0	19	11	11	7.5
October.....	29.424	29.837	78.9	92	16	86	69	26	72	19	74	73	93	17.06	11.60	25	3,491	N. W.	35	S.	3	0	17	14	16	7.4
November...	29.416	29.830	78.6	89	28	85	69	14	72	17	74	73	94	12.37	12.51	25	3,359	N. W.	32	E.	2	0	13	17	16	7.4
December...	29.389	29.802	79.5	92	21	88	68	13	71	21	73	72	89	.31	7.81	6	6,427	N. W.	27	N. E.	28	14	14	3	2	4.2
Year..	29.428	29.841	79.2	92	229	86.8	65	327	71.6	25	73.3	72.2	89.3	74.84	90.14	189	64,376	N. W.	38	N. E.	418	42	179	144	136	6.6

¹ Mean of 21 years' record.

2 April.

3 March.

4 August.

TABLE No. 7.—*Monthly meteorological data, Colon, Republic of Panama, year 1911.*

Month.	Atmospheric pressure (inches).		Air temperature (degrees Fahrenheit).										Mean wet thermometer.		Mean relative humidity (per cent).	Precipitation (inches).			Wind.					Number of days.				Average cloudiness.
	Station.	Sea level.	Mean.	Maximum.	Day.	Mean maximum.	Minimum.	Day.	Mean minimum.	Maximum daily range.	Mean temperature, dew point.		Total.	Normal.		Rainy days.	Total movement (miles).	Prevailing direction.	Miles per hour.	Direction.	Maximum velocity.	Clear.	Part cloudy.	Cloudy.	Thunderstorms.			
January.....	29.869	29.887	78.3	82	1	81	71	16	75	10	74	72	80	0.99	4.05	12	10,518	N. E.	30	N.	12	12	19	0	0	3.9		
February....	29.858	29.876	78.0	82	16	81	71	24	75	8	74	72	82	1.81	1.46	18	10,480	N. E.	30	N.	23	4	16	8	0	6.2		
March.....	29.917	29.935	78.3	82	24	82	71	2	75	10	73	71	77	1.41	1.69	13	9,606	N.	26	N. E.	6	15	16	0	0	3.9		
April.....	29.836	29.853	79.6	84	22	83	74	17	76	10	76	74	85	3.06	4.16	21	9,187	N.	28	N.	16	3	16	11	2	6.6		
May.....	29.829	29.847	79.5	88	21	85	72	9	74	15	75	75	90	17.13	12.42	28	4,148	S. E.	30	S. W.	15	0	19	12	15	7.1		
June.....	29.830	29.848	79.3	88	8	84	72	23	75	14	76	76	90	15.58	13.29	24	4,146	S. E.	25	W.	25	0	13	17	18	7.6		
July.....	29.824	29.842	81.1	86	25	84	73	2	78	10	77	76	86	14.58	16.46	22	7,233	N.	27	N.	5	2	19	10	11	6.4		
August.....	29.809	29.825	79.8	86	24	84	73	12	76	12	76	75	88	11.60	15.13	27	6,405	W.	28	W.	9	0	16	15	15	7.3		
September..	29.811	29.822	80.4	90	12	85	72	25	76	11	76	75	86	11.62	12.54	24	6,373	N.	28	N. E.	25	2	19	9	20	6.3		
October.....	29.832	29.844	79.4	90	16	84	72	7	75	14	76	75	87	16.53	14.20	25	5,386	N. W.	28	N. E.	29	3	14	14	13	6.7		
November...	29.828	29.840	79.5	89	27	84	72	14	75	15	75	75	89	15.81	21.86	23	5,583	S. E.	27	N. E.	30	3	21	6	6	6.4		
December...	29.803	29.814	82.2	89	1	86	73	11	78	14	76	74	80	2.63	12.33	16	9,222	N.	34	N. E.	29	6	24	1	0	5.1		
Year...	29.837	29.853	79.6	90	3 12	83.5	71	4 16	75.7	15	75.3	74.2	85	112.75	129.59	253	88,287	N.	34	N. E.	529	50	212	103	100	6.1		

¹ The Atlantic coast meteorological station was moved from Cristobal to Colon in August, 1911. Distance between the two stations less than 1 mile. The exposures are similar and no removal corrections are necessary.

² Mean of 41 years' record.

³ September.

⁴ January.

⁵ December.

TABLE NO. 8.—*Monthly evaporation, Canal Zone, years 1911-12, and averages.*

[Values in inches.]

Month.	Aneon.			Rio Grande.			Gatun.		Brazos Brook.		
	1911	1912	Average.	1911	1912	Average.	1911	1912	1911	1912	Average.
January.....	6.024	7.370	4.268	5.940	6.363	5.638	.....	7.208	6.293	6.066	5.660
February.....	4.530	6.755	5.041	4.912	6.134	5.525	.....	6.048	5.115	5.572	5.118
March.....	6.485	7.795	6.151	7.462	7.099	6.855	.....	7.649	6.872	7.081	6.701
April.....	4.163	5.721	4.586	5.139	6.732	5.028	.....	7.394	4.939	7.321	5.110
May.....	2.949	3.746	2.999	4.015	5.350	4.045	.....	5.335	3.290	5.707	4.064
June.....	2.812	3.098	2.610	3.646	3.836	3.239	2.799	3.263	2.917	3.729	3.413
July.....	3.869	.....	2.926	4.989	.....	3.651	4.560	.....	4.358	.....	3.471
August.....	3.117	.....	2.864	4.564	.....	3.671	4.407	.....	4.066	.....	3.672
September.....	3.595	.....	3.052	4.096	.....	3.847	4.583	.....	4.101	.....	4.025
October.....	3.595	.....	3.278	3.924	.....	3.532	3.609	.....	3.937	.....	4.094
November.....	3.181	.....	2.765	3.055	.....	2.922	2.581	.....	3.364	.....	2.745
December.....	5.300	.....	3.698	5.344	.....	3.926	5.376	.....	5.176	.....	3.434
Year.....	49.620	.....	44.238	57.086	.....	51.879	.....	.....	54.428	.....	51.507
Mean daily.....	.136	.....	.121	.156	.....	.142	.....	.....	.149	.....	.141

NOTE.—Averages at Rio Grande and Brazos Brook are based on three years' record; Aneon, four years' record. Evaporation measurements are from floating pans 4 feet in diameter and 10 inches deep at Rio Grande, Gatun, and Brazos Brook. Insulated tank 10 inches in diameter at Aneon. For monthly evaporation records during past years, see Annual Report for 1910-11.

TABLE NO. 9.—*Fogs along the canal prism, year 1911.*

Month.	Aneon.			Pedro Miguel.			Culebra.		
	No.	Duration.	Mean time commenced.	No.	Duration.	Mean time commenced.	No.	Duration.	Mean time commenced.
January.....	0	H. m.	.....	7	20 40	2.34 a. m..	6	26 25	2 a. m.
February.....	0	.. ..	.....	3	3 45	4.17 a. m..	6	26 00	2 a. m.
March.....	0	.. ..	.....	(1)	.. ..	.....	0	.. ..	.....
April.....	1	2 00	5 a. m..	6	14 15	2.55 a. m..	6	18 30	3.10 a. m.
May.....	1	1 30	5.30 a. m..	26	99 35	12.49 a. m..	22	154 20	11.40 p. m.
June.....	0	.. ..	.....	16	60 50	1.29 a. m..	26	187 30	12.13 a. m.
July.....	0	.. ..	.....	20	67 45	12.43 a. m..	27	168 40	12.03 a. m.
August.....	0	.. ..	.....	24	107 50	12.42 a. m..	26	144 45	1.02 a. m.
September.....	1	3 20	2.30 a. m..	15	77 15	1.21 a. m..	26	169 15	12.40 a. m.
October.....	0	.. ..	.....	9	26 00	2.32 a. m..	22	160 32	11.51 a. m.
November.....	4	5 15	5.22 a. m..	12	89 05	11.05 p. m..	23	127 40	12.43 a. m.
December.....	0	.. ..	.....	4	7 10	4.08 a. m..	19	95 05	1.35 a. m.
Total.....	7	12 05	.....	142	574 10	.....	209	1,278 42	.....
Mean.....	.....	1 43	4.50 a. m..	.....	4 04	1.45 a. m..	.....	6 07	12.56 a. m.
Percentage dissipated:									
By 6.30 a. m.....	29			87			38		
By 7.30 a. m.....	100			97			77		
By 8.30 a. m.....	100			99			98		

¹ Record missing.

TABLE No. 9.—*Fogs along the canal prism, year 1911*—Continued.

Month.	Bas Obispo.			Bohio.		
	No.	Duration.	Mean time commenced.	No.	Duration.	Mean time commenced.
		<i>H. m.</i>			<i>H. m.</i>	
January.....	9	27 55	3.45 a. m..	22	92 45	1.38 a. m.
February.....	8	20 43	4.13 a. m..	16	43 30	3.22 a. m.
March.....	10	24 10	3.32 a. m..	21	80 30	1.51 a. m.
April.....	18	38 10	4.21 a. m..	12	51 30	12.55 a. m.
May.....	34	109 30	1.27 a. m..	31	218 10	11.14 p. m.
June.....	33	113 20	1.48 a. m..	29	197 10	11.10 p. m.
July.....	26	76 50	3.05 a. m..	26	112 10	1.14 a. m.
August.....	31	99 20	2.48 a. m..	22	132 00	12.16 a. m.
September.....	32	82 05	3.12 a. m..	21	135 30	11.51 p. m.
October.....	30	138 35	1.49 a. m..	23	151 35	11.47 p. m.
November.....	30	161 30	12.37 a. m.	26	164 20	12 night.
December.....	20	78 05	3.22 a. m..	16	90 15	1.08 a. m.
Total.....	281	970 13	.....	265	1,469 25	.....
Mean.....	.....	3 27	2.50 a. m..	.....	5 33	12 42 a. m.
Percentage dissipated:						
By 6.30 a. m.....	64			64		
By 7.30 a. m.....	89			96		
By 8.30 a. m.....	98			100		

Month.	Gatun.			Cristobal.		
	No.	Duration.	Mean time commenced.	No.	Duration.	Mean time commenced.
		<i>H. m.</i>			<i>H. m.</i>	
January.....	1	(?) (?)	D. N. ¹	0	.. ..	.....
February.....	3	12 50	2.47 a. m..	0	.. ..	.....
March.....	1	1 45	2.30 a. m..	0	.. ..	.....
April.....	8	37 05	1.38 a. m..	0	.. ..	.....
May.....	13	48 55	2.30 a. m..	1	1 20	6.50 a. m.
June.....	10	41 15	1.44 a. m..	1	(?) (?)	D. N. A. ¹
July.....	3	12 20	1.40 a. m..	0	.. ..	.....
August.....	(²)	.. ..	.....	1	(?) (?)	D. N. A. ¹
September.....	18	59 00	2.49 a. m..	2	3 05	5.18 a. m.
October.....	18	56 45	2.41 a. m..	0	.. ..	.....
November.....	18	71 25	2.02 a. m..	0	.. ..	.....
December.....	21	30 00	4.35 a. m..	0	.. ..	.....
Total.....	114	371 20	.....	5	.. ..	.....
Mean.....	.....	3 15	2.30 a. m..	.....	.. ..	.....
Percentage dissipated:						
By 6.30 a. m.....	80			0		
By 7.30 a. m.....	96			67		
By 8.30 a. m.....	99			100		

¹ Fog began during night. Time of beginning and duration unknown.

NOTE.—One month record missing at Pedro Miguel and Gatun. Sums and means are for 11 months.

TABLE No. 10.—*Sea temperatures, 1911.*

[Temperatures of surface water in degrees Fahrenheit.]

Month.	Pacific Ocean (Balboa).					Atlantic Ocean (Colon).				
	Maxi- mum.	Date.	Mini- mum.	Date.	Monthly mean.	Maxi- mum.	Date.	Mini- mum.	Date.	Monthly mean.
January.....	81	¹ 4	76	16	79.6	83	2	78	¹ 13	80.2
February.....	81	¹ 16	71	27	77.1	83	¹ 5	78	¹ 24	80.3
March.....	80	31	66	¹ 23	71.4	84	¹ 30	78	¹ 1	80.3
April.....	82	¹ 6	77	¹ 20	79.8	85	¹ 2	79	18	81.6
May.....	85	¹ 9	81	¹ 1	83.4	86	¹ 4	79	¹ 15	82.6
June.....	86	14	81	25	82.9	86	30	79	¹ 19	82.4
July.....	85	¹ 18	82	¹ 4	83.0	86	¹ 1	82	¹ 5	84.0
August.....	85	¹ 3	82	¹ 21	83.1	87	8	82	¹ 24	84.1
September.....	86	¹ 14	82	¹ 21	83.8	87	¹ 8	83	¹ 1	84.8
October.....	85	¹ 2	81	19	83.5	87	1	77	¹ 24	81.6
November.....	85	¹ 13	81	8	83.0	86	2	78	¹ 25	81.9
December.....	83	¹ 1	81	¹ 3	81.9	85	¹ 17	79	¹ 2	81.7
Year.....	86	^{1,2} 14	66	^{1,3} 23	81.0	87	^{1,4} 8	77	^{1,6} 24	82.1

¹ Same temperature recorded on other dates also.

² June.

³ March.

⁴ August.

⁵ October.

TABLE No. 11.—*Tidal conditions, year 1911.*

[Elevation in feet referred to mean sea level.]

PACIFIC COAST (BALBOA).

Month.	Maximum high water.		Extreme low water.		Maximum daily range. ¹		Minimum daily range. ¹	
	Elevation.	Day.	Elevation.	Day.	Feet.	Day.	Feet.	Day.
January.....	+ 8.7	17	—9.4	16	17.9	17	5.9	25
February.....	+ 9.1	15	—8.7	14	17.7	15	5.2	23
March.....	+ 9.2	31	—9.0	3 and 31	18.2	31	5.1	24
April.....	+10.2	30	—9.3	1	19.2	30	5.8	22
May.....	+10.3	1	—8.6	29	18.7	1 and 29	6.8	21
June.....	+ 9.4	28	—8.6	28	18.0	28	8.4	19-20
July.....	+ 9.4	27	—8.7	26-27	18.1	27	7.8	7
August.....	+ 9.6	27	—8.5	25	18.0	26	6.4	5
September.....	+ 9.8	24	—7.9	22	17.5	24	5.2	3
October.....	+10.2	10	—8.2	11	18.2	10	5.2	2
November.....	+10.2	8	—8.6	8	18.8	8	5.5	1
December.....	+ 9.8	8	—8.7	7	18.4	7-8	7.3	1
Year.....	+10.3	² 1	—9.4	³ 16	19.2	⁴ 30	5.1	⁵ 24

PACIFIC COAST (COROZAL).

January.....			(⁶)					
February.....			(⁶)					
March.....	+ 9.4	31	—9.1	31	18.5	31	4.8	24
April.....	+10.2	29-30	—9.4	1	19.5	30	5.9	22
May.....	+10.1	1 and 22	—8.9	29	18.9	29	6.9	21
June.....	+ 9.3	27-28	—8.8	28	18.1	27-28	8.5	20
July.....	+ 9.7	27	—8.8	26-27	18.5	27	7.9	7
August.....	+ 9.7	27	—8.8	25	18.3	26	6.5	5
September.....	+ 9.8	11 and 24	—7.9	22 and 24	17.7	24	5.3	3
October.....	+10.0	10	—8.5	11	18.4	11	5.3	2
November.....	+10.1	8	—8.7	8-9	18.8	8	5.4	31
December.....	+10.0	8	—8.9	7-8	18.9	8	7.4	1
Year ⁷	+10.2	⁴ 29-30	—9.4	⁴ 1	19.5	⁴ 30	4.8	⁵ 24

ATLANTIC COAST (COLON).⁸

January.....	+1.20	12	—0.83	14	1.95	14	0.21	25
February.....	+1.34	11	— .72	22	1.70	11	.22	25
March.....	+1.08	11	— .54	9	1.61	9	.20	28
April.....	+1.01	3	— .72	7	1.57	4	.20	⁹ 1
May.....	+1.26	30	— .90	3	1.93	30	.24	3
June.....	+1.41	26	— .79	27	2.17	28	.22	8
July.....	+1.37	23	— .64	11	1.94	24	.23	23
August.....	+1.20	21	— .65	6	1.82	20	.21	24
September.....	+1.45	17	— .63	19	1.61	17	.20	⁹ 4
October.....	+1.22	16	— .48	14	1.65	14	.20	12
November.....	+1.42	9	— .72	23	1.89	10	.21	11
December.....	+1.50	7	— .77	23	1.90	7	.20	2
Year.....	+1.50	¹⁰ 7	— .90	² 3	2.17	¹¹ 28	.20	(¹²)

¹ For consecutive tides.² May.³ January.⁴ April.⁵ March.⁶ No record.⁷ No record at Corozal during January and February.⁸ One tidal fluctuation is often entirely absent at Colon.⁹ Other dates also.¹⁰ December.¹¹ June.¹² Several dates.

TABLE No. 12.—*Seismograph records, Ancon, Canal Zone. (Latitude, 8° 57' north; longitude, 79° 32' west), year ended June 30, 1912.*

[100-k. Bosh-Omori seismographs. Greenwich mean time, midnight to midnight.]

Date.	Component.	Time of beginning.			Maximum.	End.	Maximum amplitude.	Approximate distance of epicenter.
		Preliminary tremors.	Second preliminary tremors.	Long waves.				
1911.								
July 6 ¹	N.-S.	Absent.	Absent.	18.34	18.35	18.37	<i>Mm.</i> 0.1	<i>Miles.</i> (?)
	E.-W.	Absent.	Absent.	18.34	18.35	18.36	.8	
July 12 ¹	N.-S.	Absent.	Absent.	4.28	4.28	5.00	1.2	(?)
	E.-W.	Absent.	Absent.	4.28	4.28	4.59	.5	
Aug. 10 ¹	N.-S.	Absent.	5.06	5.07	5.07	5.20	2.5	(?)
	E.-W.	Absent.	5.06	5.07	5.07	5.20	2.5	
Aug. 16-17.....	N.-S.	Absent.	Absent.	18.01	18.04	0.41	1.0	(?)
	E.-W.	Absent.	Absent.	18.01	18.04	.41	1.0	
Aug. 29.....	N.-S.	3.43	3.44	3.46	3.46	4.05	6.5	600
	E.-W.	3.43	3.44	3.46	3.46	4.04	2.0	
Sept. 15.....	N.-S.	13.16	13.21	13.27	13.20	13.48	.8	2,300
	E.-W.	13.16	13.21	13.27	13.30	13.47	.5	
Sept. 17 ¹	N.-S.	4.24	(?)	(?)	4.35	4.58	.8	(?)
	E.-W.	4.24	(?)	(?)	4.35	4.58	.5	
Oct. 6.....	N.-S.	10.19	10.21	10.23	10.22	11.00	2.5	1,000
	E.-W.	10.19	10.21	10.23	10.27	11.00	2.0	
Oct. 10.....	N.-S.	13.14	Absent.	13.15	13.18	13.58	43.0	400
	E.-W.	13.14	Absent.	13.15	13.17	13.59	18.0	
Oct. 26.....	N.-S.	14.16	Absent.	14.17	14.18	14.41	10.0	300
	E.-W.	14.16	Absent.	14.17	14.17	14.39	4.0	
Oct. 29 ¹	N.-S.	18.18	18.22	18.22	18.22	19.09	5.0	1,450
	E.-W.	(?)	(?)	18.20	18.30	(?)		
Nov. 1.....	N.-S.	9.29	9.31	9.32	9.34	9.59	6.0	500
	E.-W.	9.29	9.31	9.32	9.33	9.46	3.0	
Nov. 20.....	N.-S.	13.53?	(?)	13.57	14.00	14.07	.5	(?)
	E.-W.	13.53?	(?)	13.57	13.58	14.07	.2	
Dec. 6 ¹	N.-S.	23.09	(?)	23.12	23.22	23.42	1.0	(?)
	E.-W.	23.09	(?)	23.12	23.20	23.36	.5	
Dec. 9.....	N.-S.	9.34	Absent.	9.36	9.36	9.49	4.0	300
	E.-W.	9.34	Absent.	9.36	9.36	9.46	2.0	
Dec. 11.....	N.-S.	12.48	Absent.	12.50	12.50	13.04	3.0	300
	E.-W.	12.48	Absent.	12.50	12.50	13.00	2.0	
Dec. 16.....	N.-S.	19.20	Absent.	19.24	19.24	20.19	3.0	875
	E.-W.	19.20	Absent.	19.24	19.24	20.01	3.0	
Dec. 22.....	N.-S.	13.00	Absent.	13.04	13.04	13.27	.7	825
	E.-W.	13.00	Absent.	13.04	13.04	13.15	.4	
Dec. 23.....	N.-S.	21.07	21.08	21.09	21.10	21.45	24.0	500
	E.-W.	21.07	21.08	21.09	21.10	21.39	8.5	
Dec. 25.....	N.-S.	9.40	Absent.	9.41	9.43	10.11	2.5	250
	E.-W.	9.40	Absent.	9.41	9.43	10.00	1.5	
1912.								
Feb. 21.....	N.-S.	7.57	Absent.	7.58	8.00	8.13	5.0	460
	E.-W.	7.57	Absent.	7.58	7.58	8.10	2.5	
Feb. 25 ¹	N.-S.	Absent.	Absent.	5.39	5.40	5.41	1.0	(?)
	E.-W.	Absent.	Absent.	5.39	5.40	5.41	1.0	
Mar. 19.....	N.-S.	18.20	Absent.	18.21	18.21	18.30	1.0	330
	E.-W.	18.20	Absent.	18.21	18.21	18.30	1.0	
Mar. 28 ¹	N.-S.	Absent.	Absent.	22.08	22.10	22.12	.2	(?)
	E.-W.	Absent.	Absent.	22.08	22.10	22.12	.2	
Mar. 31.....	N.-S.	18.28	Absent.	18.28	18.29	18.31	.7	225
	E.-W.	18.28	Absent.	18.28	18.29	18.30	.4	
Apr. 13.....	N.-S.	13.55	Absent.	13.59	14.02	14.08	.5	(?)
	E.-W.	13.55	Absent.	13.59	14.02	14.07	.2	
Apr. 15.....	N.-S.	22.21	Absent.	22.22	22.22	22.23	1.0	(?)
	E.-W.	22.21	Absent.	22.22	22.22	22.22	.7	
Apr. 17 ²	N.-S.	3.51	Absent.	3.51	Pen off.	4.25	68.0	225
	E.-W.	3.51	Absent.	3.51	3.52	4.22	40.0	
Apr. 17.....	N.-S.	15.52	Absent.	15.54	15.54	16.12	2.5	300
	E.-W.	15.52	Absent.	15.52	15.54	16.08	2.0	
May 10.....	N.-S.	15.40	Absent.	15.41	15.41	15.50	2.5	300
	E.-W.	15.40	Absent.	15.41	15.41	15.47	1.0	
May 11.....	N.-S.	5.03	Absent.	5.06	5.06	5.20	1.5	(?)
	E.-W.	5.03	Absent.	(?)	(?)	5.13	.1	
June 6.....	N.-S.	6.16	6.18	6.19	6.20	6.44	4.0	700
	E.-W.	6.17	6.18	6.19	6.20	6.35	1.5	
June 12.....	N.-S.	12.46	Absent.	12.48	12.50	13.30	3.5	550
	E.-W.	12.46	Absent.	12.48	12.46	13.20	2.0	

¹ Record indistinct, evidently produced by earthquake of distant origin.² Record incomplete; pen passed off sheet. Period of pendulum 25 seconds. Magnification 10. Damping, medium. The amplitude indicates half of the complete range of maximum motion. Laska's formula used in computing distances in the case of remote earthquakes (620 miles or more); and Omori's formula for earthquakes less than 620 miles distant.

HYDROGRAPHY.

The hydrographic conditions obtained on all streams tributary to Gatun Lake and Miraflores Lake during the period July 1, 1911, to July 1, 1912, are of special interest, chiefly because during that period the minimum dry season and total flow for 12 consecutive months for years of record (Jan. 1, 1890, to July 1, 1912) has occurred. The previous minimum dry-season flow occurred during the calendar year 1908. The total flow for the calendar year 1911 was the minimum flow for calendar years of record except 1905. The relative flow at Alhajuela for the dry seasons of 1908 and 1912 is shown on plate 100. This diagram gives the daily and monthly means for the two periods and shows at a glance the deficiency for the dry season of 1912, as compared with the previous driest season. The minimum elevations of the Chagres River were 91.0 at Alhajuela on April 20, 1912, and 43.5 at Gamboa on May 7–8, 1912, establishing new low-water records for both stations. The previous low-water records were 91.86 for Alhajuela on April 26, 1905, and 44.40 for Gamboa on April 4, 1911.

Table No. 13 gives the maximum, minimum, and mean discharge, by months, at Alhajuela, and Gamboa, for the year 1912 to June, and the 1908 means for comparison. This table includes yield of Gatun Lake watershed for the same periods.

Table No. 14 gives the discharge for the calendar year 1911, while plates 101, 102, and 103 compare the mass curves for the discharges for 1908, 1911, and 22-year period (1890–1911) at Alhajuela, Gamboa, and Gatun, respectively.

The minimum discharge recorded on all the streams, measured regularly during the calendar year, is given in Table No. 15.

GAUGINGS.

Regular field work has been carried on as usual by the hydrographers and observers at the different stations. At Alhajuela the work has consisted of 139 gaugings on the main river and the keeping of continuous records of river heights. The gaugings have been made to cover the total fluctuations of the river, or from elevation 91 to 103.6, and were distributed so as to give accurate results as to the quantity of water flowing throughout the year. The channel conditions remained practically the same, making very reliable work possible. The measurements at this station were checked by 33 sets of gaugings on the Upper Chagres, Pequeni, and La Puente Rivers, near Vigia. In addition to this work the hydrographer at the station has had charge of the gaugings on the Gatuncillo, Chilibre, and Chilibrillo Rivers, on which streams 50, 53, and 11 measurements, respectively, were made.

The gauging work at Gamboa consisted of 90 current meter measurements. During the dry season the work was done from a boat at a section just below the old French fluviograph. The excavation work at the cable station made reliable results at that point impossible. The accompanying cross-section, plate 104, shows the various conditions. On account of these adverse channel conditions it was difficult to obtain reliable discharge estimates of the river at this point. However, by the use of the river elevations at both the old

French fluviograph and at the water-stage register by the cable-gauging station, in connection with the gaugings at the two sections, fairly accurate estimates have been obtained. During the dry season, when channel conditions were most unfavorable, the work was checked by the total flow of the Chagres at Alhajuela and of the Gatuncillo and Chilibre Rivers.

Progress on the spillway dam at Gatun made it possible to completely shut off the flow through the spillway. This was first done on February 9, 1912. The other dates of regulation of the three sluice gates and one cylindrical valve in the spillway dam and the storing effect on Gatun Lake are shown in the accompanying hydrograph of Gatun Lake, plate 105. The discharge of the spillway was estimated from elevations at the spillway water-stage register and discharge curves constructed from 118 current meter gaugings taken during the year. During the periods of low flow wading measurements were made in the concrete channel. The estimates for the yield of the Chagres River Basin, above Gatun, by months, are based on the use of the capacity curve for lake, supplemented by discharge of spillway and evaporation from lake surface. Table No. 13 gives these results from January to June, 1912.

Backwater from Gatun Lake has interfered with gauging work on the Trinidad River during the greater part of the year. Up until the middle of March, 1912, but few gaugings were made on this account. Since March 18 gaugings have been made, on an average, twice a week on the Trinidad Branch and the Siri River at points above Trinidad Station, a sufficient distance to be above the backwater effect. On the Gatun River gaugings have been made intermittently at a point above the backwater effect of the level above Panama Railroad embankment at Monte Lirio. Several gaugings were made at the Quebrancha culverts, where most of the water found its way into Gatun Lake. Above elevation +40 this level overflows through the drawbridge channel. Elevations of this level were observed twice each day and reported by telephone.

Work on the Cãno River was continued, although this stream felt the backwater effect of Gatun Lake. Since February this stream has been gauged semimonthly.

Besides the gaugings mentioned above, weekly gaugings were made on the other streams listed in Table No. 15, which gives the minimum flow recorded at all gauging stations for the dry season of 1912.

FRESHETS.

Vigia, Alhajuela, and Gamboa have been used as warning stations during the freshet stages of the river. During the river year ended April 30, 1912, there were 22 freshets which had a rise of more than 5 feet at Vigia. The average ratio of the Gamboa rise to the Vigia rise for this period was 0.715, the maximum ratio being 0.90 and the minimum 0.60. The average for the previous year was 0.749 for 44 freshets. A comparison of the number of freshets for the two years is a good indication of the relative flow for the two periods. Table No. 16 gives the four principal freshets for the year 1911, there having been no freshets up to June 30, 1912, that reached +56 elevation at Gamboa. Very satisfactory measurements of maximum discharge were obtained at Alhajuela, Gamboa, and Gatun.

The maximum discharges at Bohio, as given in the table, were estimated from the area of the cross-section and slope of river.

For predicting the probable height at Gamboa the above ratios between Gamboa and Vigia rises were employed as during the previous year. For predicting probable elevations of Gatun Lake a study of the volume of flow into the lake from past rises was made, noting what portion of this flow passed Alhajuela and Gamboa up to the time of the crest at each station, and also the total flow for the 24-hour periods. The relation between the flow at Alhajuela, Gamboa, and the total flow into the lake for given periods (generally one, two, or three days) indicated what might be expected to occur under similar conditions. This method was found to be much more reliable than taking the ratio between actual rises on the lake and at Gamboa or Alhajuela. At the time of predicting elevations for the lake the influence of the Trinidad River on the situation was always an unknown factor, but as a general rule the error was always on the side of safety.

In order to estimate the maximum discharge and freshets on smaller streams, use was made of maximum gauge floats, with which these streams were equipped. The actual results were obtained from the area of the cross sections and the mean velocities as estimated from actual gaugings.

SPECIAL WORK.

In order to determine the proper reduction coefficients for flood gaugings at Gamboa and Gatun, extensive work was done at these two stations on vertical velocity curve measurements. At Gamboa the results of 65 measurements indicated that a coefficient of 0.90 applied to the surface observations gave good results, while the results of 151 observations at Station 42, on Gatun Spillway, gave a coefficient of 0.85.

During spring tides, for months of February to May, 1912, special current meter observations were made on the tide currents at Balboa, in canal channel, opposite Panama Railroad docks. A total of 27 observations were made, each observation consisting of determining the velocity at points from surface to bottom for a particular location and stage of tide. The maximum velocity recorded was 0.81 mile per hour.

OFFICE WORK.

Daily hydrographic reports have been received and published with the meteorological reports. All gaugings have been computed, checked, tabulated, and filed. Monthly discharge curves have been constructed and discharge tables made. Data from current meter ratings have been calculated, checked, and rating tables compiled. Monthly reports of hydrographic work and conditions, including discharge estimates and hydrology computations, have been submitted. In the line of special work, attention to studies of the relation between rainfall and run-off over the whole Chagres Basin for a long period has been continued, as well as similar studies for Rio Grande reservoir. Plate 106 shows results for Gatun Lake watershed for river year 1911-12.

The following plates and tables accompany the report of this section:

- Plate 100. Comparison of dry-season flow for 1908 and 1912 at Alhajuela.
 Plate 101. Mass curves for discharge at Alhajuela, 1911, 1908, 22-year period.
 Plate 102. Mass curves for discharge at Gamboa, 1911, 1908, 22-year period.
 Plate 103. Mass curves for discharge at Gatun, 1911, 1908, 22-year period.
 Plate 104. Cross section of Chagres River at Gamboa.
 Plate 105. Hydrograph of Gatun Lake for January-June, 1912.
 Plate 106. Diagram showing relation between rainfall and run-off for Gatun Lake watershed.
 Plate 107. Discharge duration curve, Alhajuela.
 Plate 108. Discharge duration curve, Gamboa.
 Plate 109. Discharge duration curve, Gatun.
 Table 13. Monthly discharge at Alhajuela, Gamboa, and Gatun for 1912 to June.
 Table 14. Monthly discharge at Alhajuela, Gamboa, and Gatun for 1911.
 Table 15. Minimum discharge on all streams for dry season, 1912.
 Table 16. Principal freshets for 1911.
 Table 17. Discharge at Gatun and Gamboa for dry and wet seasons and calendar years during years of maximum and minimum flow.
 Table 18. Discharge at Gatun and Gamboa for wet and dry seasons and river years during years of maximum and minimum flow.

TABLE NO. 13.—*Monthly discharge, Chagres River, January to June, 1912 and 1908.*

[Discharge in second-feet.]

ALHAJUELA.

[Drainage area, 427 square miles.]

Month.	Year 1912.			1908 mean.
	Maximum.	Minimum.	Mean.	
January.....	968	560	734	1,005
February.....	1,360	400	516	582
March.....	500	320	382	585
April.....	2,530	250	371	592
May.....	25,300	275	1,682	2,595
June.....	11,890	970	1,857	2,213
Six months.....	25,300	250	924	1,262

GAMBOA.

[Drainage area, 559 square miles.]

January.....	1,020	600	801	1,230
February.....	1,400	400	542	710
March.....	470	320	366	710
April.....	1,940	250	372	720
May.....	22,900	260	1,777	3,410
June.....	11,600	1,145	2,161	2,910
Six months.....	22,900	250	1,003	1,615

TABLE No. 13.—*Monthly discharge, Chagres River, January to June, 1912 and 1908—Continued.*

GATUN LAKE.

[Drainage area, 1,320 square miles.]

Month.	Year 1912.						Mean discharge, 1908.
	Mean elevation above sea level.	Discharge of spillway.	Storage. ¹	Evapora- tion.	Yield of watershed.		
					Net.	Total.	
January.....	14.38	1,351	<i>Sec.-ft.</i> — 170	<i>Sec.-ft.</i> 126	1,181	1,307	1,976
February.....	14.42	310	+ 682	113	992	1,105	1,046
March.....	17.07	0	+ 482	161	482	643	851
April.....	17.08	722	— 366	161	356	517	892
May.....	19.33	0	+2,692	130	2,692	2,822	5,046
June.....	27.48	1,347	+2,999	131	4,346	4,477	5,625
Six months.....	18.29	622	+1,053	137	1,675	1,812	2,473

¹ + increase; — decrease.

TABLE No. 14.—*Monthly discharge, Chagres River, year 1911.*

ALHAJUELA.

[Drainage area, 427 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on watershed).
	Maximum.	Minimum.	Mean.	Per square mile.	
January.....	2,310	1,230	1,640	3.84	4.427
February.....	43,600	1,070	2,310	5.41	5.634
March.....	1,420	630	881	2.06	2.375
April.....	9,070	635	1,689	3.96	4.418
May.....	15,000	1,520	2,790	6.53	7.528
June.....	40,100	1,390	2,881	6.75	7.531
July.....	35,600	1,100	2,609	6.11	7.044
August.....	37,100	1,090	2,359	5.52	6.364
September.....	8,510	1,130	1,830	4.29	4.786
October.....	23,600	1,290	2,407	5.64	6.502
November.....	20,000	2,020	3,553	8.32	9.283
December.....	2,350	970	1,391	3.26	3.758
Year.....	43,600	630	2,195	5.14	69.650

GAMBOA.

[Drainage area, 559 square miles.]

January.....	3,070	1,260	1,766	3.16	3.643
February.....	34,800	1,100	2,362	4.22	4.394
March.....	1,460	700	976	1.75	2.018
April.....	7,400	830	1,756	3.14	3.503
May.....	12,500	1,630	3,178	5.68	6.548
June.....	30,000	1,460	3,020	5.40	6.025
July.....	38,090	1,270	3,516	6.29	7.252
August.....	35,120	1,270	2,781	4.98	5.741
September.....	8,150	1,420	2,348	4.20	4.686
October.....	26,150	1,560	3,319	5.94	6.848
November.....	17,560	2,620	4,856	8.68	9.684
December.....	2,790	1,000	1,528	2.73	3.147
Year.....	38,090	700	2,617	4.68	63.489

TABLE NO. 14.—*Monthly discharge, Chagres River, year 1911—Continued.*

GATUN.

[Drainage area, 1,320 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on watershed).
	Maximum.	Minimum.	Mean.	Per square mile.	
January.....	8,250	1,960	3,636	2.75	3.170
February.....	6,240	1,700	2,999	2.27	2.364
March.....	2,460	1,020	1,439	1.09	1.257
April.....	3,370	1,020	2,071	1.57	1.752
May.....	8,120	2,780	5,952	4.51	5.200
June.....	10,200	4,580	6,488	4.92	5.489
July.....	14,590	2,230	6,905	5.23	6.030
August.....	8,040	2,650	4,525	3.43	3.954
September.....	6,560	3,075	4,506	3.41	3.805
October.....	12,350	4,570	7,266	5.50	6.341
November.....	16,790	9,970	12,764	9.67	10.789
December.....	9,970	1,580	4,042	3.06	3.528
Year.....	16,799	1,020	5,216	3.95	53.679

TABLE NO. 15.—*Table giving minimum discharge of various streams during the dry season, 1912.*

Stream and location.	Date.	Dis-charge.	Remarks.
		<i>Sec.-feet.</i>	
Gatun spillway.....			See special table.
Chagres River:			
Gamboa.....	Apr. 20 and 21.....	250.00	From discharge curve.
Alhajuela.....	do.....	250.00	Do.
Upper Chagres, Dos Bocas.....	May 7.....	186.00	Gauging.
Pequeni, Dos Bocas.....	Apr. 10.....	72.60	Do.
La Puente, Vigia.....	May 2.....	1.77	Do.
Gatuncillo.....			Dry Apr. 2 to May 16.
Chilibre.....	Apr. 18.....	.57	Gauging.
Chilibrillo.....	Apr. 15.....	.49	(Probably lower on 18th to 21st.)
Siri River, above Trinidad.....	Apr. 18.....	25.00	Gauging.
Trinidad Branch, above Trinidad.....	Apr. 12.....	17.50	Do.
Gatun River, at Quebrancha culverts.....	May 9.....	30.10	Drainage above railroad embankment.
Cano River, near Zone boundary.....	Apr. 30.....	8.67	Gauging.
Agua Salud, at Panama Railroad.....	May 9.....	1.36	Do.
Frijolito, at Panama Railroad.....	do.....	1.61	Do.
Frijoles Grande, at Panama Railroad.....	do.....	.02	Estimated.
Frijoles, at Panama Railroad.....	do.....	.08	Do.
Obispo diversion, Gamboa.....			Dry Feb. 27 to June 22.
Mandingo, near Bas Obispo.....	Apr. 2.....	.18	
Pedro Miguel.....	Apr. 6.....	.20	Gauging.
Caimitillo, at culvert.....			Dry Feb. 12 to Apr. 30.
Camaron, at culvert.....	Apr. 8.....	.11	Gauging.
Cocoli, above reservoir.....	do.....	.16	Do.
Rio Grande:			
Bridge No. 57, Panama Railroad.....	Apr. 9.....	.24	Do.
Above reservoir.....	do.....	.20	Do.

TABLE No. 16.—*Principal freshets for year 1911.*

Date of beginning.	Vigia.		Alhajuela.			
	Eleva- tion of crest.	Rise.	Eleva- tion of crest.	Rise.	Hours after Vigia.	Maximum discharge.
						<i>Cubic foot- seconds.</i>
Feb. 12.....	145.5	19.3	105.5	13.8	1	43,600
June 22.....	142.0	15.2	103.6	10.4	1	40,100
July 5.....	141.4	14.0	103.0	9.2	1	35,600
Aug. 21.....	141.9	15.4	103.5	10.4	1	37,100

Date of beginning.	Gamboa.					
	Eleva- tion of crest.	Rise.	Hours after Vigia.	Per cent of Vigia rise.	Per cent of Alha- juela rise.	Maximum discharge.
						<i>Cubic foot- seconds.</i>
Feb. 12.....	58.4	12.8	5½	67.0	93.0	34,800
June 22.....	57.1	10.8	5	71.1	104.0	30,000
July 5.....	58.3	10.3	5½	81.0	130.0	38,090
Aug. 21.....	57.5	11.4	6	74.0	110.0	35,120

Date of beginning.	Bohio.					
	Eleva- tion of crest.	Rise.	Hours after Gamboa.	Per cent of Gam- boa rise.	Per cent of Alha- juela rise.	Maximum discharge.
						<i>Cubic foot- seconds.</i>
Feb. 12.....	21.1	8.0	7½	62.0	58.0	¹ 29,000
June 22.....	20.7	5.3	7½	49.1	51.0	¹ 24,600
July 5.....	22.9	6.1	8½	54.0	56.0	¹ 30,200
Aug. 21.....	20.5	5.7	6	50.0	55.0	¹ 25,400

Date of beginning.	Gatun.					
	Eleva- tion of crest.	Rise.	Hours after Gamboa.	Per cent of Gam- boa rise.	Per cent of Bohio rise.	Maximum discharge.
						<i>Cubic foot- seconds.</i>
Feb. 12.....	15.7	2.6	11½	20.0	32.0	6,240
June 22.....	17.6	2.3	28½	21.3	43.4	9,830
July 5.....	19.4	3.4	36	34.0	56.0	14,590
Aug. 21.....	16.6	1.9	34	25.0	33.0	8,040

¹ Estimated.

TABLE No. 17.—*Discharge at Gatun and Gamboa, for dry and wet seasons and calendar years during years of maximum and minimum flow.*

[Dry seasons (January to April), 4 months, and wet seasons (May to December), 8 months.]

Stations, values, and period.	1912	1911	1910	1909	1908	1905 ¹	1890-1911
	Minimum dry season on record.	Minimum year total (except 1905).	Maximum year total for Gatun.	Maximum year (total and wet season for Gamboa; wet season for Gatun).	Minimum dry season flow (except 1912).	Minimum year (total and wet season).	Average for 22-year period.
GATUN.							
Average discharge in second-feet:							
4 dry months.....	795	2,536	6,513	4,032	1,191	1,713	3,189
8 wet months.....		6,556	13,954	13,971	8,087	6,017	9,655
Year.....		5,216	11,472	10,658	5,788	4,582	7,500
VOLUME DISCHARGE IN BILLION CUBIC FEET:							
4 dry months.....	8.30	26.19	67.99	41.65	12.51	17.85	33.29
8 wet months.....		138.37	295.33	295.68	170.84	127.35	204.26
Year.....		164.56	363.32	337.33	183.35	145.20	237.55
GAMBOA.							
Average discharge in second-feet:							
4 dry months.....	520	1,715	3,868	2,932	842	1,066	1,638
8 wet months.....		3,068	6,009	8,305	4,702	2,338	4,143
Year.....		2,617	5,295	6,514	3,416	1,914	3,308
VOLUME DISCHARGE IN BILLION CUBIC FEET:							
4 dry months.....	5.47	17.61	40.20	30.26	8.85	11.12	17.09
8 wet months.....		64.89	127.38	175.76	99.35	49.50	87.69
Year.....		82.50	167.58	206.02	108.20	60.62	104.78

¹ 1912 will probably be minimum year and minimum wet season.

1906 and 1907 not years of wet or dry flow.

TABLE NO. 18.—*Discharge at Gatun and Gamboa for wet and dry seasons and river years during years of maximum and minimum flow.*

[River year May 1 to Apr. 30. Wet seasons (May to December) 8 months, and dry seasons (January to April), 4 months.]

Stations, values, and period.	1911-12 Minimum dry sea- son on record.	1910-11 Maxi- mum river year and wet season except 1909-10.	1909-10 Maxi- mum river year, wet season and dry season.	1908-09	1907-08 Minimum dry sea- son for Gatun except 1912.	1905-06 Minimum river year and wet season.	1890-1912 22-year period.
GATUN.							
Average discharge in second- feet:							
8 wet months.....	6,556	13,954	13,971	8,087	7,421	6,017	9,655
4 dry months.....	795	2,536	6,518	4,032	1,191	1,542	3,074
River year.....	4,636	10,148	11,486	6,735	5,344	4,526	7,462
Volume discharge in billion cu- bic feet:							
8 wet months.....	138.37	295.33	295.68	170.84	156.89	127.35	204.26
4 dry months.....	8.30	26.19	67.99	41.65	12.51	16.05	31.87
River year.....	146.67	321.52	363.67	212.49	169.40	143.40	236.13
GAMBOA.							
Average discharge in second- feet:							
8 wet months.....	3,068	6,009	8,305	4,702	4,231	2,338	4,143
4 dry months.....	520	1,715	3,868	2,932	842	1,816	1,592
River year.....	2,219	4,578	6,826	4,112	3,101	1,830	3,292
Volume discharge in billion cu- bic feet:							
8 wet months.....	64.89	127.38	175.76	99.35	89.50	49.50	87.69
4 dry months.....	5.47	17.61	40.20	30.26	8.85	8.44	16.51
River year.....	70.36	144.99	215.96	129.61	98.35	57.94	104.20

¹ Dry season Gamboa except 1911-12.

River years 1906-7 and 1908-9 not years of wet or dry flow.

ZONE LAND SURVEY.

During the year observations were made at 10 additional secondary triangulation stations, and the adjustment of the whole system was completed, including the computation of the geodetic positions. The difference in elevation between the various triangulation stations was determined by trigonometric leveling. Several of the elevations obtained in this manner were checked by means of stadia traverses run to determine property lines, and the results agreed very well.

The traversing of the principal rivers, ridges, and trails was concluded in the early part of the year. The total length of line run in connection with this work was 225.176 miles, of which 113.793 miles were trail, 92.256 miles river line, 13.467 miles swamp line, and 5.66 miles shore line. The total miles of line run on the Zone land survey is 566.122, of which 150.089 miles are section line, 40.644 miles auxiliary line run in connection with the section lines, 150.213 miles ridge line, 113.793 miles trail line, 92.256 miles river line, 13.467 miles swamp line, and 5.66 miles coast line.

Rail and concrete monuments were placed at 22 section corners in the southeast quadrant.

The traverses of the Zone land survey, after having been computed and balanced, were platted on maps of 1/5000 scale. The topographical features developed from the traverse were transferred to the 1/20000 scale and 1/40000 scale maps. After all the available data from other sources were placed on these maps they were prepared for lithographing.

MISCELLANEOUS SURVEYS.

A stadia survey was made to locate the ridge line between the upper Gatun River and the Atlantic Ocean. Nineteen miles of line were run between Mount Bruja and Santa Rita Mountain. The traverses were worked up and the work platted on a 1/5000 scale map.

A stadia survey was made of the Atlantic coast line in the vicinity of Margarita Island, near Colon. A triangulation station was established on Margarita Point. The Majagual and Escondido Rivers were run up to the limits of tidewater. Several islands and inlets not heretofore shown on maps were located.

One of the precise level bench marks (6-A) was relocated and three new bench marks were established on Guarapo Island.

The field and office work for the land office of the commission, including special surveys, staking out lots, running old boundary lines, and preparation of maps has been regularly performed.

MECHANICAL WORK.

There have been no marked changes in the conduct of mechanical work on the Isthmus during the past year. The details of what has been accomplished is covered by report of Maj. T. C. Dickson, Ordnance Department, United States Army, inspector of shops, which is attached hereto marked as an appendix. Constant efforts have been made during the year to reduce the cost of repairs to equipment. A marked reduction has been made in car repairs. All of the equipment has been growing older, and general repairs were required to a greater extent during the past fiscal year than during any previous year. This is especially true for locomotives, largely on account of stay bolts breaking, flues becoming defective, and tires wearing out. The total cost of repairs per service day during the past year compared with similar information for the previous year is given in the following table:

Item of equipment.	Fiscal year 1911.			Fiscal year 1912.		
	Service days.	Total expense.	Average cost per service day.	Service days.	Total expense.	Average cost per service day.
Locomotives.....	63,926	\$504,008.10	\$7.88	65,305	\$559,766.23	\$8.57
Steam shovels.....	21,775	483,536.88	22.21	20,303	465,883.49	22.95
Unloaders.....	3,417	50,564.45	14.80	3,375	48,773.98	14.45
Spreaders.....	2,290	33,815.41	14.77	2,517	35,846.37	14.24
Track shifters.....	1,170	2,632.84	2.25	1,592	4,415.11	2.77
Locomotive cranes.....	5,851	43,502.39	7.44	7,093	53,822.23	7.59
Pile drivers.....	1,173	6,676.15	5.69	1,902	16,082.02	8.46
Unloader plows.....	3,417	11,291.45	3.30	3,124	7,678.98	2.46

Car repairs, 1911, \$894,496.55, or \$0.8656 per car per working day.

Car repairs, 1912, \$807,782.29, or \$0.7487 per car per working day.

The amount of electric current generated and the cost per kilowatt-hour for the different plants for the past fiscal year as compared with the preceding year is given in the following table:

Location of plants.	Fiscal year 1911.			Fiscal year 1912.		
	Kilowatt hours.	Expenses.	Cost per kilowatt hour.	Kilowatt hours.	Expenses.	Cost per kilowatt hour.
Balboa ^{1,2}	1,404,475	\$57,150.02	\$0.04069	1,430,685	\$53,951.08	\$0.03771
Empire ³	2,514,710	73,744.98	.02933	2,494,890	70,434.54	.02823
Gorgona ¹	867,149	37,558.02	.04331	1,115,728	36,411.07	.03263
Total mechanical division plants.....	4,786,334	168,353.02	.03517	5,041,303	160,796.69	.0319
Miraflores ³	6,797,714	186,532.15	.02744	9,522,400	218,311.23	.02292
Gatun ⁴	12,962,247	293,825.56	.02267	16,263,510	357,996.12	.02201
Total, construction division plants.....	19,759,961	480,357.71	.02431	25,785,910	576,307.35	.02235

¹ Includes in 1912, 74,350 kilowatt hours furnished by Miraflores plant.

² Original cost of these plants has been charged to divisions on basis of benefits received. The product is invoiced to departments and divisions at a price that provides for renewals and new machinery; includes cost of construction and maintenance of lines, wiring, and lights both outside and inside.

³ Includes \$0.0100 per kilowatt hour to absorb cost of plant. Cost is for current delivered at switchboard.

⁴ Includes \$0.0103 per kilowatt hour to absorb cost of plant. Cost is for current delivered at switchboard.

The cost of air compressed at the principal plants during the past year as compared with the record of the previous year is as follows:

Location of plants.	Fiscal year 1911.			Fiscal year 1912.		
	Output (cubic feet).	Total cost.	Cost per 1,000 cubic feet.	Output (cubic feet).	Total cost.	Cost per 1,000 cubic feet.
Las Cascadas.....	1,512,594,874	\$46,439.08	\$0.0307	1,169,166,579	\$35,778.85	\$0.0306
Empire.....	4,483,713,554	149,448.06	.0333	4,823,829,781	148,112.82	.0307
Rio Grande.....	1,773,887,622	55,890.62	.0315	2,059,671,314	67,127.35	.0326
Balboa.....	491,003,491	15,757.32	.0321	742,489,779	23,355.28	.0314
Total.....	8,261,199,541	267,535.08	.0324	8,795,157,453	274,374.30	.0312

The total cost of repairs to equipment and the cost per cubic yard during the past year as compared with the previous year are given in the following table:

Item of work.	Fiscal year 1911.			Fiscal year 1912.		
	Amount of work accomplished (cubic yards).	Total cost of repairs.	Cost per cubic yard.	Amount of work accomplished (cubic yards).	Total cost of repairs.	Cost per cubic yard.
Excavation:						
Dry.....	20,266,574	\$1,759,565.26	\$0.0868	19,391,874	\$1,610,592.04	\$0.0831
Wet.....	11,936,972	571,907.03	.0479	10,910,235	737,224.10	.0676
Concrete.....	1,742,928	359,296.88	.2061	1,443,570	252,268.92	.1748
Sand.....	936,760	228,928.47	.2444	749,491	140,250.91	.1871
Stone.....	1,719,857	432,256.51	.2513	1,344,825	291,612.81	.2168
Fill:						
Dry.....	3,019,036	93,376.40	.0309	5,760,921	330,075.37	.0573
Wet.....	4,276,791	115,329.02	.0270	3,199,127	125,630.82	.0393

The average cost of dry excavation in the central division, and of wet excavation in the Atlantic and Pacific divisions, for all work accomplished to June 30, 1912, is as follows:

Division.	Item of work.	Cost per cubic yard.			
		Work.	Plant.	General expenses.	Total.
Central division.....	Dry excavation...	\$0.6240	\$0.1078	\$0.0766	\$0.8084
Atlantic division.....	Wet excavation...	.1629	.0587	.0217	.2433
Pacific division.....	do.....	.1594	.0779	.0204	.2577

The average cost of concrete laid in the Atlantic and Pacific divisions to June 30, 1912, is as follows:

Division.	Cost per cubic yard.			
	Work.	Plant.	General expenses.	Total.
Atlantic division.....	\$6.4407	\$0.7028	\$0.3167	\$7.4602
Pacific division.....	4.4412	.5852	.3030	5.3294

The cost of repairs to marine equipment of the Isthmian Canal Commission and the Panama Railroad Co. during the past fiscal year is shown in the following table:

Item of equipment.	Quantities excavated.	Total cost of repairs.	Cost per cubic yard.	Cost per month per unit.
ATLANTIC DIVISION.				
Sea going suction dredge: Caribbean.....	<i>Cubic yards.</i> 2,804,807	\$71,629.80	\$0.0255	\$5,969.15
Dipper dredges:				
Mindi.....	340,429	43,099.38	.1266	3,591.62
Chagres.....	342,613	51,097.15	.1491	4,258.09
Total.....	683,042	94,196.53	.1379	3,924.85
Ladder dredges:				
No. 1.....	386,712	42,904.87	.1109	3,575.41
No. 5.....	617,406	37,442.72	.0606	3,120.22
No. 6.....				
Total.....	1,004,118	89,347.59	.0800	3,347.82
Tugs:				
Bohio.....		28,160.53		2,346.71
Gatun.....		35,989.35		2,999.12
Empire.....		12,837.18		1,069.76
Porto Bello.....		12,851.95		1,070.99
Mariner.....		10,867.76		905.65
Reliance ¹		21,316.10		2,842.15
De Lesseps.....		9,189.01		765.75
Exotic ²		833.73		238.20
Total.....		132,045.61		1,590.91

¹ This tug was in the service of the Atlantic division until Feb. 11, 1912, when it was transferred to Pacific division. It was then taken to Balboa via Cape Horn, arriving June 17, 1912.

² Retired from service Oct. 17, 1911.

Item of equipment.	Quantities excavated.	Total cost of repairs.	Cost per cubic yard.	Cost per month per unit.
PACIFIC DIVISION.				
	<i>Cubicyards.</i>			
Seagoing suction dredge: Culebra.....	2,414,297	\$58,530.94	\$0.0242	\$4,877.57
Dipper dredge: Cardenas.....	399,136	39,473.43	.0989	3,289.45
Ladder dredges:				
Marmot.....	516,242	10,969.72	.0212	914.14
Badger.....	1,025,779	18,038.22	.0176	1,503.18
Mole.....	174,822	10,502.41	.0601	875.20
Gopher ¹	564,837	15,033.86	.0266	1,252.83
Corozal ²	153,626	21,834.36	.1421	7,278.12
Total.....	2,435,306	76,378.57	.0314	1,497.62
Tugs:				
Cocoli.....		12,898.33		1,074.86
Chame.....		4,843.05		403.59
Miraflores.....		7,064.55		588.72
La Boea.....		6,750.06		562.50
Reliance ³		1,762.02		3,524.04
Total.....		33,318.01		686.97

¹ Engaged in dredging sand at Chame.

² In service from April, 1912.

³ This tug was in the service of the Atlantic division until Feb. 11, 1912, when it was transferred to Pacific division. It was then taken to Balboa via Cape Horn, arriving June 17, 1912.

Statement of fuel consumed by Isthmian Canal Commission and Panama Railroad.

	Fiscal year 1910-11.				Fiscal year 1911-12.			
	Coal.	Oil.		Total.	Coal.	Oil.		Total.
		Quan- tity.	Equiva- lent in coal.			Quan- tity.	Equiva- lent in coal.	
Isthmian Canal Commis- sion.....	<i>Tons.</i> 364,403	<i>Barrels.</i> 679,928	<i>Tons.</i> 169,982	<i>Tons.</i> 534,385	<i>Tons.</i> 356,557	<i>Barrels.</i> 769,921	<i>Tons.</i> 192,408	<i>Tons.</i> 538,963
Panama Railroad Co.....	50,796	104,714	26,178	76,974	44,828	106,404	26,601	71,429
Total.....	415,199	784,642	196,160	611,359	401,385	876,325	219,009	610,394

NOTE.—4 barrels of oil assumed to equal 1 ton of coal.

TABLE A.—Statement of rolling stock owned by the Isthmian Canal Commission in use by the different departments, as of July 1, 1912.

Description.	Atlantic division.	Central division.	Pacific division.	Panama R. R.	Office of the chief engineer.	Quartermaster's Department, store.	Disbursing office.	Mechanical division.	Fortification board.	Total.
Cars:										
50-ton steel flats.....	28	43	26	384				1	5	487
40-ton wood flats (Lidgerwoods).....	25	1,617	17	101						1,760
Narrow-gauge flats—										
3-foot gauge.....	43									43
3½-foot gauge.....	13		32							45
Decauville, ½-meter gauge.....	72	72				80				224
12-yard Western, dump.....	13	224	235	50		18			39	579
18-yard Western, dump.....	126	142		11					12	291
2-yard Western, dump.....									20	20
4-yard dump, 3-foot gauge.....	38								6	44
6-yard dump, 3½-foot gauge.....	57									57
12-yard Oliver dump.....	5	216	346	29		21			11	628
18-yard Oliver dump.....	202	27	50						26	305
Goodwin dump.....		12								12
Ingoldsby dump.....		12								12
Pay.....							1			1
Pay certificate.....		1								1
Special for castings and coal.....								12		12
Electroautomatic railway, Gatun handling plant.....	45									45
Cranes (various).....	17	5	15	8					2	47
Locomotives:										
201 class, American Locomotive Works.....	7	78	14	1						100
301 class, Baldwin Locomotive Works.....	11	20	9					1		41
400 class.....	7	1	3			1		1	3	16
500 class.....	4	10	22			3		1	1	41
600 class.....	1	19								20
700 class.....	1	3	7	1		23			6	41
800 class (3 and 3½-foot gauge).....	19		12						2	33
American, 8-wheel.....		2								2
Decauville, ½-meter gauge.....		1				2				3
Special.....								1		1
Electric Industrial Ry., Gatun handling plant.....	9									9
Motor cars.....	1	1	1		3					6
Velocipedes.....			1							1
Steam shovels:										
Model 20, Marion.....									1	1
Model 60, Marion.....			2			4			4	10
Model 91, Marion.....	4	7	4							15
45-ton Bucyrus.....		2	2	1		6				11
70-ton Bucyrus.....	10	7	9	1		3			3	33
95-ton Bucyrus.....		30								30
Type 1, Thew.....			1							1
Spreaders.....	3	12	5	4		1			1	26
Unloaders.....	2	22	1			4			1	30
Track shifters.....	2	5	2							9
Pile drivers.....	6	3	3	1					1	14

TABLE B.—*Statement of Isthmian Canal Commission floating equipment on the Isthmus, as of July 1, 1912.*

Description.	Atlan- tic di- vision.	Pacific di- vision.	Quar- termas- ter's depart- ment.	Sani- tary depart- ment.	Civil admin- istra- tion.	Lights and buoys.	Fortifi- cation board.	Total.
Barges:								
Cement.....	6							6
Coal.....	6	2						8
Coal o. f. s.....	3							3
House-boats.....	2	1						3
Mud dumps.....	10	7						17
Stone and sand.....		9						9
Steel dump.....								
Rock drill.....	1	1						2
Steel.....	13	3					3	19
Rock breaker.....		1						1
Wrecking.....		1						1
Disinfecting.....				1				1
Oil.....	1	1						2
Coal hoist.....		1						1
Machine shop.....	1	1						2
Water.....		1						1
Self-dumping, wooden.....	1							1
Floating pump, concrete.....								
Diving.....		1						1
Derrick.....	2							2
Clapets.....	4	6					2	12
Launches:								
Gasoline.....	7	5		2	4	1	2	21
Steam.....	2	6						8
Dredges:								
Seagoing suction.....	1	1						2
Dipper.....	2	1						3
Ladder.....	2	5						7
Pipe-line.....	7							7
Double-end clamshell.....	1							1
Tugs:								
First class.....	5	4						9
Second class.....	2							2
Floating pile drivers.....	2	1						3
Floating crane.....	1							1
Towboat, stern wheel.....			1					1
Tenders.....		1		1				2

TABLE C.—*Statement of equipment owned by the Panama Railroad Co., as of July 1, 1912.*

Rolling equipment.	In Pan-ama R. R. service.	In service of Isthmian Canal Commission.					In service of fortification board.	Total.
		Atlan-tic di- vision.	Cent-ral di- vision.	Pacific di- vision.	Quar-termas-ter's depart-ment.	Me-chanical di- vision.		
Locomotives:								
Road.....	22	7	1	6			1	37
Switch.....	23	2	2					27
Total.....	45	9	3	6			1	64
Cars, passenger:								
Special.....	2							2
Parlor.....	1							1
Pay.....	1							1
Labor.....	1							1
Coaches—								
First class.....	21							21
Second class.....	22							22
Hospital.....	2							2
Baggage and mail.....	8							8
Total.....	58							58
Cars, freight:								
Box.....	929	15	42	15			5	1,006
Coal.....	38	1			1			40
Flat.....	17		5	2				24
Fast freight.....	19							19
Local express.....	2							2
Stock.....	20							20
Specie.....	2							2
Total.....	1,027	16	47	17	1		5	1,113
Cars, service:								
Caboose.....	16						1	17
Water (tank).....	3							3
Ballast (Rodger).....	174	26						200
Outfit.....	85						1	86
Construction.....	12							12
Refrigerator.....	22							22
Total.....	312	26					2	340
Miscellaneous:								
Cranes—								
25-ton.....							1	1
10-ton.....						1		1
75-ton.....	1		1					2
Pile drivers.....	2							2
Ditching machine.....	1							1
Total.....	4		1			1	1	7
Floating equipment:								
Tugs.....	2							2
Motor boat, 40-horsepower.....	1							1
Floating pile driver.....	1							1
Cargo lighters.....	8							8
Coal lighters.....	5							5
Launch, gasoline.....	1							1

Lubricating and illuminating oils and lubricating greases, including gasoline, which cost the commission and Panama Railroad Co. a total of \$80,641.04 in the fiscal year 1910-11; cost, during the fiscal year 1911-12, \$75,906.37, a reduction of about 6 per cent.

The traveling engineers and the inspector of lubricants and equipment have continued their efforts to reduce the unit cost of fuel and lubricant consumption. To this end comparative monthly performance sheets for each different class of equipment are compiled and copies furnished to each individual engineer or posted prominently.

PERSONNEL.

During the year Maj. T. C. Dickson, Ordnance Department, United States Army, has performed the duties of inspector of shops.

Mr. A. B. Nichols, office engineer, has been in charge of the drafting room, drawings, and old French records in the chief engineer's office.

Civil Engineer F. H. Cooke, United States Navy, was detailed by the Navy Department for special duty with the commission and has been principally engaged since he reported, on January 9, 1912, on the design of the dry docks and coaling plants.

Mr. James G. Craig has filled the position of senior traveling engineer. Mr. A. C. Stone, junior traveling engineer, resigned July 30, 1911, and Mr. Don E. Irwin, traveling engineer for the inspection of fuel and oil consumption, was appointed junior traveling engineer on August 1, 1911. Mr. James E. Johnson was appointed inspector of fuels and lubricants on August 21, 1911.

Mr. Geo. I. Finley, assistant engineer, was placed in charge of the design of the structural work for the permanent shop buildings, effective June 10, 1912.

Mr. C. M. Saville, assistant engineer in charge of the third division of the chief engineer's office, resigned, effective January 2, 1912. The third division was abolished on January 24, 1912, and its work transferred to the second division of the chief engineer's office.

Mr. Guy O. Fraser, junior engineer, acting in charge of the third division for a portion of the year, resigned, effective June 23, 1912.

Mr. R. R. Wiggins, assistant engineer in charge of field work of the third division, resigned, effective October 28, 1911.

Mr. P. H. Underwood, assistant engineer in charge of office work of the third division, resigned, effective October 11, 1911.

Mr. D. F. Pyne, clerk in charge of the third division, resigned, effective April 3, 1912.

Mr. O. E. Malsbury, junior engineer, remained in charge of the field and office work of the land office.

Mr. R. C. Jones, junior engineer, has, during the latter half of the fiscal year, had charge of Zone land surveys and miscellaneous surveys.

Mr. F. D. Willson, inspector of meteorological and hydrographic work under the third division, was appointed supervisor of meteorological and hydrographic work, effective May 1, 1912. Mr. H. G. Cornthwaite has remained in charge of the meteorological section, and Mr. H. T. Critchlow has continued in charge of the hydrographic section.

All officers and employees have performed their work in an efficient manner during the year.

Very respectfully,

H. H. ROUSSEAU,
Civil Engineer, United States Navy,
Member Isthmian Canal Commission,
Assistant to the Chief Engineer.

Col. GEO. W. GOETHALS,
Corps of Engineers, United States Army,
Chairman and Chief Engineer,
Culebra, Canal Zone.

EXHIBIT.

The following plates, tables, and diagrams accompany the report of this division:

METEOROLOGICAL AND HYDROGRAPHIC.

- Plate 98. Annual rainfall along canal location.
- Plate 99. Wind roses, year 1911, dry and rainy seasons.
- Plate 100. Comparison of dry season flow for 1908 and 1912 at Alhajuela.
- Plate 101. Mass curves for discharge at Alhajuela, 1911, 1908, 22-year period.
- Plate 102. Mass curves for discharge at Gamboa, 1911, 1908, 22-year period.
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MISCELLANEOUS.

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APPENDIX TO APPENDIX F.

REPORT OF MAJ. T. C. DICKSON, ORDNANCE DEPARTMENT,
UNITED STATES ARMY, INSPECTOR OF SHOPS, DEPARTMENT
OF CONSTRUCTION AND ENGINEERING.

ISTHMIAN CANAL COMMISSION,
OFFICE OF THE CHIEF ENGINEER, SECOND DIVISION,
Culebra, Canal Zone, July 31, 1912.

SIR: I have the honor to submit the following report on the work under my jurisdiction during the fiscal year ended June 30, 1912.

The different shops and the principal mechanical apparatus used on construction work have been inspected and the results thereof, with recommendations, submitted monthly on Form 276, C. E. The inspections have included night shifts in shops and hostling establishments. Three hundred and fifty-three inspections of shops were made during the year, of which 52 were made at night.

Among the other duties performed during the year have been the making of investigations of cases especially assigned, service on committees and boards, transfer of construction equipment in special cases, and preparation of floor plans for permanent shops.

The table following shows for each shop the number of superintendents, master mechanics, and foremen constituting the supervisory force, the pay per month of the supervisory force, the number of gold and silver employees, and total number of employees on June 30, 1911, December 31, 1911, and June 30, 1912.

Number and pay per month of supervisors and number of gold and silver employees and total number of employees in each shop on June 30, 1911, Dec. 31, 1911, and June 30, 1912.

Shop.	June 30, 1911.			Dec. 31, 1911.			June 30, 1912.		
	Supervisory force.		Number of employees in shop.	Supervisory force.		Number of employees in shop.	Supervisory force.		Number of employees in shop.
	Number.	Pay per month.		Number.	Pay per month.		Number.	Pay per month.	
Dry dock.....	12	\$2,070.00	Gold. 134	12	\$2,070.00	Gold. 117	10	\$1,760.60	Gold. 105
Porto Bello.....	3	585.00	36	5	784.52	29	1	175.00	20
Spillway and dam.....	3	375.00	3	2	300.00	3	2	300.00	3
Toro Point.....	1	200.00	10	1	200.00	12	1	200.00	6
Empire.....	12	2,400.00	153	12	2,400.00	140	12	2,400.00	116
Balboa.....	10	1,538.90	73	9	1,580.80	67	8	1,445.00	63
Gamboa.....	1	200.00	8	1	200.00	9	1	200.00	5
Gatun.....	5	830.00	48	3	550.00	35	3	550.00	24
Gold Hill ¹				1	175.00	2	1	175.00	3
Gorgona.....	36	6,735.30	830	42	7,652.48	765	42	7,718.68	743
Las Cascadas.....	4	710.00	23	4	710.00	24	2	375.00	16
Pedro Miguel.....	8	1,405.00	76	8	1,405.00	76	7	1,205.00	61
Panama Railroad at Cristobal.....	5	970.00	37	5	930.00	29	5	865.00	27
Panama Railroad at Panama.....	1	112.50	1	1	112.50	1	1	112.50	1
Total.....	101	18,131.70	1,432	106	19,070.30	1,309	96	17,482.38	1,193
									2,805
									3,998

¹ Established Sept. 1, 1911.

The net decrease in supervisory force in all shops during the year was 5; in monthly pay of supervisors, \$649.32; in gold employees, 239; and in silver employees, 68. The total force in all shops decreased 7 per cent during the year.

The total monthly pay roll in each shop during the year, as taken from Form 222, C. E., is shown in the following table:

Total pay roll of each shop and total pay roll of all shops per month during the fiscal year ended June 30, 1912.

Shop or division.	1911					
	July.	August.	September.	October.	November.	December.
Dry dock.....	\$32,682.02	\$31,774.93	\$30,104.38	\$30,662.36	\$26,975.18	\$27,970.90
Porto Bello.....	6,719.66	7,099.31	6,606.58	6,068.35	6,089.29	5,656.37
Spillway and dam.....	2,230.27	2,652.86	2,153.19	2,977.54	2,326.70	2,596.93
Toro Point.....	3,161.82	2,709.31	2,515.97	2,475.47	2,301.60	3,011.29
Empire.....	27,100.80	27,756.46	26,510.99	27,889.19	25,886.75	26,779.22
Balboa.....	21,477.85	21,598.39	21,034.43	25,302.96	21,528.87	23,343.53
Mechanical division.....	165,614.82	170,283.22	165,996.28	173,508.89	172,117.62	178,449.57
Panama R. R.....	13,905.80	14,965.85	13,728.04	14,202.96	13,066.58	13,524.01
Total.....	272,893.04	278,840.33	268,649.86	283,087.72	270,292.59	281,331.82

Shop or division.	1912					
	January.	February.	March.	April.	May.	June.
Dry dock.....	\$30,036.48	\$29,469.84	\$29,565.89	\$28,053.40	\$27,964.04	\$26,899.37
Porto Bello.....	5,089.84	5,381.53	5,686.20	5,147.81	5,826.77	2,986.42
Spillway and dam.....	3,566.12	3,624.24	3,972.95	3,640.23	3,934.15	3,723.33
Toro Point.....	2,537.68	2,684.75	2,403.94	2,232.65	2,221.05	2,030.07
Empire.....	28,678.22	27,469.01	26,716.89	26,043.56	26,494.65	25,223.40
Balboa.....	22,267.26	19,368.73	21,450.98	21,089.46	22,135.87	22,618.47
Mechanical division.....	190,274.15	185,671.04	192,923.00	177,717.43	174,338.00	170,609.63
Panama R. R.....	14,028.34	13,568.74	14,261.76	14,982.36	14,836.09	15,468.71
Total.....	296,478.09	287,237.88	296,981.61	278,906.90	277,750.62	269,559.40

The total pay roll in all shops was \$403,890.26 less than during the previous year.

The quantity of a few classes of mechanical equipment in service was reduced and the quantity of some classes was increased during the year. There was no material reduction in the total amount of repair work.

Less manufacturing work was done than during the previous year. The major part of the reduction in cost of the shops during the year was due to decrease in amount of work and the remainder to increased efficiency.

The following table shows the cost of overtime work done in all shops for each month during the year:

Total overtime of each shop and total overtime of all shops per month during the fiscal year ended June 30, 1912.

Shop or division.	1911					
	July.	August.	September.	October.	November.	December.
Dry dock.....	\$1,057.21	\$568.60	\$1,723.70	\$1,559.13	\$935.13	\$1,286.38
Porto Bello.....	56.76	221.81	211.70	256.88	184.98	.....
Spillway and dam.....	37.15	83.05	36.20	93.51	95.43	168.42
Toro Point.....	72.61	86.27	78.01	86.23	196.38	272.81
Empire.....	382.72	155.12	1,077.56	1,081.11	447.77	564.10
Balboa.....	1,256.09	1,414.94	936.40	2,590.15	1,709.22	1,273.69
Mechanical division.....	3,980.79	6,453.99	9,159.71	8,606.33	10,692.02	11,768.02
Panama R. R. ¹.....	.....	.....	.....	.....	.....	.....
Total.....	6,843.33	8,983.78	13,223.28	14,273.34	14,260.93	15,334.02
Percentage overtime to total pay roll.....	2.51	3.22	4.92	5.04	5.28	5.45

Shop or division.	1912					
	January.	February.	March.	April.	May.	June.
Dry dock.....	\$1,554.90	\$1,981.04	\$999.55	\$686.68	\$367.29	\$494.17
Porto Bello.....	56.38	58.86	131.82	40.36	40.86	173.74
Spillway and dam.....	435.80	493.18	307.31	235.53	379.39	130.56
Toro Point.....	237.53	185.37	106.08	169.93	70.80	4.80
Empire.....	669.98	750.60	636.36	435.17	719.16	555.64
Balboa.....	1,256.38	944.86	1,951.41	1,661.22	1,861.78	2,368.67
Mechanical division.....	9,264.94	10,866.13	11,808.42	8,753.69	5,408.30	9,885.09
Panama R. R. ¹	235.28	351.93	482.80	349.97	321.13	311.84
Total.....	13,711.19	15,631.97	16,423.75	12,332.55	9,168.21	13,924.51
Percentage overtime to total pay roll.....	4.62	5.44	5.47	4.42	3.30	5.17

¹ Overtime not reported until January, 1912.

There was an increase in the demand for certain classes of equipment during the year and the resultant shortage forced construction officials to order a larger part of repairs made on overtime. The flues in many locomotives required at least partial renewal during the year, and the shortage of locomotives necessitated part of the renewal being done on overtime. A study was made with the view to decreasing the amount of overtime but it was found that working three shifts in the Gorgona plant would not result in an appreciable saving, as a large part of the overtime is done on Sundays and holidays.

The hour at which craftsmen and their helpers begin work at hostling establishments was changed, with few exceptions, to 9 p. m., by which hour sufficient locomotives requiring repairs are placed to enable all craftsmen to start work promptly. This change reduced the amount of overtime.

Four and fifty-eight hundredths per cent of the total shop pay rolls during the year was paid for overtime.

The following table shows the shop-expense percentage effective in each shop during the year under Circular No. 169-E:

Division or shop.	Shop-expense per cent.			
	May 1, 1911.	Sept. 1, 1911.	Feb. 1, 1912.	May 1, 1912.
Mechanical division.....	37.5	37.5	35	37.5
Empire shop.....	40	30	20	40
Dry dock shop.....	45	45	50	40
Balboa shop.....	30	25	25	40
Porto Bello shop.....	25	20	30	45
Panama R. R. shop.....	45	45 ¹	30	30
Toro Point shop.....			40	50

¹ Thirty per cent prescribed effective Jan. 1, 1912.

The effect of uniformity in cost-keeping system and in shop management is shown by the shop-expense percentages approaching the same value. The special character of the work done in the Panama Railroad shops makes its shop expense incomparable with that in the other shops.

Cost of hostling.—The average cost of direct labor per hostling for standard-gauge equipment hostled by the mechanical division was 2½ cents less than during the previous year. The lowest average cost of direct labor per hostling in a month during the year at any hostling establishment under the mechanical division was 72 cents and was attained at Las Cascadas during the month of July.

Cristobal shops.—These shops are owned by the Panama Railroad Co. and are under the jurisdiction of the general superintendent thereof. The paint shop and the copper and tin shop were closed at the beginning of the fiscal year. All excepting five machines in the planing mill were shut down permanently; a motor was installed to drive the excepted machines and a bolt threader and a small shear. All wood parts required in repairing freight cars are framed in the Gorgona shops and kept in stock by the storekeeper at Cristobal.

The general foreman of the car department was transferred on July 1, 1911, to the same position in the mechanical division, but retained general supervision over the car department of the Panama Railroad.

The car shop repairs all freight and labor cars, excepting heavy repairs to 100,000-pounds capacity steel flat cars, and makes light repairs only to coaches, cabooses, baggage and refrigerator cars. It is supervised by one foreman, assisted by three leadingmen. The inspection of and field repairs to freight cars of the Panama Railroad are made principally in the Mount Hope yard; the inspectors are under the jurisdiction of the general foreman of the car department. The efficiency of the inspection service was increased by reducing the hours of work of the inspectors from 12 to 8 hours per day.

The efficiency of the car shop was materially increased by a reorganization made on March 1, 1912, by the system inaugurated of keeping on hand a stock of timber (framed at Gorgona) required for all classes of repairs made in this shop, and by the use of spray machines for painting freight cars. During the year 970 cars were

given general repairs, 378 were given heavy repairs, and 399 light repairs in this shop.

The organization and force in the roundhouse remained practically unchanged. The machines installed in the roundhouse last year have enabled all necessary running repairs to be made promptly and economically to locomotives. During the year eight class 651, four class 101, and seven switch engines of the Panama Railroad were given heavy repairs at Gorgona in addition to three casualty repairs. This was the first general overhauling given the class 651 engines since they were put in service.

The construction of the new docks at Cristobal required a large number of steel cylinders 5 feet in length and 3, 4, and 6 feet in diameter. Most of the cylinders were assembled in sections from 10 to 45 feet in length. This work was done by the mechanical division with a force organized for the purpose in the empty boiler, machine, and erecting shops at Cristobal. The cost of the work was reduced by the purchase of two 72-inch-throat power riveters. This work was started in October, 1911, and by June 30, 1912, 6,150 cylinders 4 and 6 feet in diameter were completed. A motor-driven swing saw was purchased and installed in the car shop for cutting up wood removed from cars for use as fuel in the boilers, which has reduced the cost of power.

Porto Bello, Toro Point, and spillway shops.—These three small shops are under the jurisdiction of the division engineer of the Atlantic division.

Work in the Porto Bello shop was increased by the opening of the breakwater quarry and decreased by the closing of the crusher plant on April 30, 1912.

The shop at Toro Point made repairs for the fortifications division in addition to that for the breakwater. The force in this shop has been reduced 45 per cent on account of decrease in rolling stock and steam shovels used on the breakwater.

The spillway shop on the Gatun Dam has continued without material change.

Dry-dock shops.—This shop is under the jurisdiction of the division engineer of the Atlantic division. In addition to maintaining the dredging and transportation fleets at the Atlantic end of the canal, this shop has made such repairs to vessels as have been required by the Panama Railroad Co., private companies, and individuals, and minor repairs to miscellaneous equipment in the vicinity, including repairs to the Brown coal hoist and cantilever crane. The splicing of cables, making of rope fenders, etc., done near Dock 13 was transferred to this shop.

The force in this shop was reduced 17 per cent during the year. A reduction of two assistant foremen, one at \$160 per month in the machine shop and one at \$150 per month in the carpenter shop, was made during the year.

The quantity of work which this shop has been called on to perform during the year has varied greatly; when necessary, congestion was relieved by obtaining additional craftsmen temporarily from the mechanical division under Circular No. 357. This shop has obtained more additional craftsmen in this manner than all the other shops.

Gatun shop.—This shop is part of the mechanical division and makes light repairs to rolling stock and other mechanical equipment

used by the Atlantic and first divisions and by other departments at and in the vicinity of Gatun. It is also a hostling establishment.

Since March, 1912, General Foreman Perry, in addition to his other duties, has inspected the mechanical equipment used in the construction of the Gatun locks, under Maj. J. P. Jervcy, resident engineer.

Lieut. Col. Sibert, division engineer of the Atlantic division, turned over to this shop, in October, 1911, the inspection and repair of standard-gauge cars used on the Gatun Dam.

All surplus serviceable material in and around the shop was returned to the Quartermaster's Department and the value thereof credited to the Atlantic division and all unserviceable material was submitted for condemnation.

The gold force in this shop was reduced 50 per cent during the year.

Gamboa shop.—This is an hostling establishment and is part of the mechanical division. The amount of equipment cared for at this place decreased during May and June, and the force has been reduced 30 per cent. The facilities for coaling and sanding engines at this place are not economical.

Gold Hill.—The mechanical division established an outdoor hostling establishment at Gold Hill on September 1, 1911. Running repairs only are made to engines tying up at this place.

Las Cascades shop.—This hostling establishment is part of the mechanical division, and its management has been highly efficient during the year. Its supervisory force was reduced by two assistant foremen and the day repair force removed. The force in this shop was reduced 30 per cent during the year.

Pedro Miguel shop.—This shop is part of the mechanical division. All of the cars of the central division that run out of the south end of Culebra Cut and all standard-gauge cars of the Pacific division are repaired in it to the extent permitted by its facilities. With the approval of Mr. S. B. Williamson, division engineer of the Pacific division, the making of light repairs to cars at Cocoli was stopped in April, 1912, and bad-order cars sent to Pedro Miguel.

The night car-repair force was continued throughout the year.

The making of running repairs to and the hostling of locomotives constitute the principal work in this shop. Light repairs are also made to other mechanical equipment of the Pacific and first divisions.

During the first part of the year a number of complaints were made in regard to hostling of and repairs to locomotives. The hours of duty of the general foreman were changed to cover the afternoon and first part of the night, which change resulted in some improvement. The supervisory force was reorganized early in May, and a marked increase in efficiency and a decided decrease in complaints have resulted. The force in this shop was increased 8 per cent during the year on account of the increase in the amount of equipment used by the Pacific division.

In connection with this shop a repair foreman and gang make field repairs to mechanical equipment in the Pedro Miguel and Miraflores locks, except to chamber and berm cranes and narrow-gauge engines and cars, and to all steam shovels used in the Pacific division and on fortification work at the Pacific end of the canal.

The outdoor hostling of engines at East Balboa dump continued during the year. The number of engines hostled increased. Loco-

motives are coaled by hand from cars. No repairs are made at this place, which is under the supervision of the general foreman at Pedro Miguel.

Empire shop.—This plant is under the jurisdiction of the division engineer of the central division, and is principally engaged in manufacturing spare parts for steam shovels and rock drills and in repairing steam shovels, rock drills, hand and push cars, and track jacks and drills, and doing carpenter work required in the Culebra Cut.

The decrease in the amount of work in this shop enabled the gold force to be reduced 24 per cent during the year. The position of inspector of material was abolished in February, 1912, and the work assigned to other employees.

The distribution-slip system installed at Gorgona and dry-dock shops during the previous year was introduced in this shop on September 1, 1911, with improved results.

Mr. W. H. Bates, superintendent of steam-shovel repairs, made periodic inspections during the year of steam shovels in use by the different departments and divisions and assisted in reducing the cost of repairs and in the maintenance of the stock of spare parts.

With the approval of Col. Gaillard, division engineer of the central division, plans submitted for the transfer of the Empire shops to the mechanical division, for the transfer of all manufacturing and heavy repair work to Gorgona shops, and for the reduction of the force in the Empire shops to that required for making light repairs were approved and the transfer ordered to be made on July 1, 1912, by Circular No. 349-A. Day and night repairs to steam shovels in the central division will continue to be made from the Empire shops, and the carpenter shop will be continued as before. The principal saving that will result from this consolidation will be effected in shop expense.

Balboa shop.—This shop is under the jurisdiction of the division engineer of the Pacific division, and is engaged principally in the maintenance of the dredging and transportation fleet at the Pacific end of the canal. This also makes such repairs to vessels of other departments and individuals and companies as may be required. The force was reduced about 6 per cent. The supervisory force was reduced by consolidating the positions of outside leadingman and foreman of the machine shop and by abolishing the position of painter and mason foreman at \$150 per month.

Gorgona plant.—All manufacturing work and heavy repairs to the mechanical equipment used by the Isthmian Canal Commission and Panama Railroad—except marine equipment, steam shovels, rock drills, etc.—are done in this plant. It is the main plant of the mechanical division, of which Mr. A. L. Robinson is superintendent.

The principal changes in the number of supervisors in this plant consisted in changing five leadingmen on an hourly basis to assistant foremen on a monthly basis and the transfer of the direct supervision over one repair foreman from Pedro Miguel shop.

Several changes in the personnel of supervisors occurred during the year. When Mr. A. T. Corcoran, general foreman of the locomotive department, resigned, the position he occupied was filled by the transfer of Mr. J. J. Eason from the position of general foreman

of the car department, and the latter position was filled by the transfer of Mr. J. Belt, general foreman of the car department of the Panama Railroad Co. This latter change enabled the supervision over the inspection and repairs to all standard-gauge cars on the mainland to be consolidated, with increased efficiency and economy.

The method of repairing cars, particularly wood cars, was improved, including the relieving of craftsmen from the performance of fatiguing unskilled labor. The cost of repairs to wood cars was increased by the shortage of sills during about half of the year. The cost of the direct labor used in inspecting and repairing wood and steel cars for the central division was 3.11 mills per cubic yard excavated less than during the previous fiscal year, or a reduction of \$53,314.94 for the year's output. The steel bodies of many 100,000-pounds capacity steel flat cars had deteriorated by rusting; as fast as these cars could be spared from service all metal parts were cleaned with the sandblast and painted.

The system inaugurated last year of inspecting finished work before shipment has proved most beneficial. No piece of equipment after being repaired is released until it has been tested out under as nearly service conditions as can be simulated. During the fiscal year 10,574 finished jobs were inspected, at an average cost of 38.54 cents each. During the last four months 72 jobs rejected by the inspector of finished material for minor errors were accepted without change by construction officials, 201 jobs were passed after completing omitted work or correcting errors, and 21 jobs were finally rejected.

Departments and divisions reported, under Circular No. 384, 6 cases of unsatisfactory work and 16 cases of slow delivery on the part of the mechanical division during the year. One of the six complaints covered defective work done prior to the establishing of the inspection system. This record requires no comment.

This plant received 11,093 and completed 11,027 work orders during the year; 588 work orders remained unfinished on June 30, 1912.

The average number of gold employees at work on the last day of each month during the year was 682, and of silver employees 1,117. The force in this plant was reduced 6 per cent during the year.

During the year 7,476,011 pounds of iron castings were made in the foundry, and the uncompleted orders at the end of the year amounted to 1,174,374 pounds. Some cylinders for piston rings were of improper composition. The quality of some bronze castings has been below the standard. The cost of patterns was charged to the job instead of the foundry account during the year. The average cost of iron castings made during the year was 2.74 cents per pound.

The installation of the 2-ton Tropenas converter and its accessories were completed and the making of steel castings begun in February. The quality of the output has improved and the cost decreased with the experience gained. The output of steel castings during almost five months was 199,803 pounds, and the average cost during that period was 11.18 cents per pound. During the year 350,711 pounds of brass castings were made, at an average cost of 18.06 cents per pound.

The installation of the acid dipping plant for cleaning brass work was completed. Additional oxy-acetylene tanks, two 72-inch throat-power riveters, four spray-paint machines, and a rivet buster were purchased.

There were transferred to this plant during the year a radial drill, drill press, sticker, surfacer, swing saw, and two pipe machines.

Circular No. 343-C, issued on December 29, 1911, requires all fusible plugs to be filled at this plant, to enable responsibility for defective plugs to be fixed.

The pay car remained in one place while the employees from all parts of the plant walked to it and considerable working time was lost. With the assistance of the disbursing officer, the plant was divided into sections for purposes of paying off, the pay car was switched to each section in turn, and the employees in that section only were paid at one time. This system reduced the working time lost on pay day about one-half.

During the first nine months of the year the planing mill was worked to nearly its full capacity both day and night. Shortage of sills and of certain sizes of stock lumber increased the amount of work in the planing mill.

A swing saw was installed in the wood-car shop by which condemned lumber taken from cars is cut up and sent to hostling establishments; the cost of this kindling wood does not appreciably exceed the previous cost of removing the lumber from the shop.

The preparation of a bill of material, of foremen's requisitions, and of necessary drawings for each manufacturing shopwork order in the drafting room has continued to be of material benefit.

The system described in last year's report for fixing the limiting dates on which each foreman should start in order to complete the part of the work under his charge on each shopwork order by the date required has proved of great assistance to the foremen, coordinated the work of the various shops on each order, and has materially conduced to the completion of work by the dates of delivery required by construction officials.

The maximum capacity of the plant, the number of employees, and the occasional receipt at about the same time of an unusually large number of rush and short-time delivery orders have prevented the completion of all orders on time; the exceptions have not been numerous.

The oxy-acetylene plant has been taxed at times to supply the amount of gases required.

The night shifts in the machine, erecting, blacksmith, boiler, carpenter, and wood-car shops, and the planing mill were continued throughout the year.

General.—The mechanical committee, consisting of the superintendent, master mechanic, and general foreman of the principal shops, and the inspector of shops, discussed at its meetings shop rules, shop practices, methods of performing work, and other matters relating to mechanical work. Greater uniformity and coordination among the different shops have resulted. The meetings were changed from monthly to bimonthly by Circular No. 383-A, dated December 27, 1911.

Endeavor has been made to have castings made at Gorgona machined at that place, whenever practicable, to save the extra handling involved in machining them at other shops.

Circular No. 264-A, dated January 19, 1911, which fixed the labor and material that shall be charged directly to jobs and to shop expenses, was amended by Circular No. 264-B, dated November 28, 1911, to require the cost of all tools, templets, dies, fixtures, etc., to be charged to shop expense, with the exception that those of special character made for use on work done for private individuals and companies will be charged directly to the job.

To effect economy in the maintenance of rolling stock and steam shovels, Circular No. 323-B was issued on April 27, 1912, requiring that when a piece of equipment in service must be given a general overhauling the superintendent of the mechanical division will ascertain if there is a piece of surplus equipment of the same class that can be repaired at less cost, and if so that the latter be repaired and substituted for it.

Circular No. 262-F, dated October 9, 1911, requires the approval of the inspector of shops to the employment on the Isthmus for work in shops of all gold employees. The employment of 182 applicants was approved, of which number 80 were boilermakers and 75 were machinists of different grades.

One hundred and sixty-eight craftsmen, clerks, and mechanical draftsmen were appointed in the United States on requisitions of the mechanical division during the year, of which 63 were machinists, 35 were boilermakers, 14 were molders, 16 were blacksmiths, and 10 were hostlers.

A number of changes in the personnel of the supervisory force in the shops occurred during the year, which have resulted, on the whole, in increased efficiency.

Permanent shop.—During the year a list of the machines in all shops was prepared and the machines required in the permanent shop at Balboa, and to be retained in the dry-dock shop, were selected. Floor plans of the different shops that are to constitute the permanent plant at Balboa, showing the arrangement of the machines and equipment therein, and a tentative layout of the buildings were prepared and submitted to you.

Respectfully submitted.

T. C. DICKSON,
Major, Ordnance Department, U. S. Army,
Inspector of Shops.

Civil Engineer H. H. ROUSSEAU, U. S. Navy,
Assistant to the Chief Engineer, Isthmian Canal
Commission, Culebra, Canal Zone.

APPENDIX G.

REPORT OF A. L. ROBINSON, SUPERINTENDENT, MECHANICAL DIVISION, DEPARTMENT OF CONSTRUCTION AND ENGINEERING.

GORGONA, CANAL ZONE, *August 1, 1912.*

SIR: In accordance with your circular letter of June 8, I have the honor to submit herewith annual report covering the operations of the mechanical division for the fiscal year 1911-12.

Throughout this year the mechanical division has operated under practically the same organization as that maintained during the former year, but with a slightly increased force and personnel, due to increased work.

The policy of concentrating manufacturing work and repairs to rolling equipment in Gorgona shops has been continued. The forces in outlying or district shops have been limited to only that number of men necessary to carry on the actual running and field repairs to equipment operating in each district, these shops having the privilege of calling upon the central (Gorgona) shop for temporary additional forces whenever the exigencies of their work make it more advisable to send out men than to bring in the equipment.

The concentration of all classes of mechanical work in Gorgona has resulted in this shop being operated up to its maximum capacity for eight hours during each working day and to about one-third of its capacity during a second shift of eight hours. The employment of two shifts enables this shop to work 16 hours out of each 24 upon all rush and short-time delivery orders without the employment of any overtime, at one and one-half times the usual rate of pay. In addition, the operation of any shop up to its maximum capacity produces more efficient results than where the fluctuation of work necessitates the reduction or increase of forces.

The concentration of work in Gorgona shops during the past year has resulted in this shop handling a monthly average of work as follows:

Heavy or general repairs to locomotives.....	17
Repairs to all classes of cars.....	1,500
Repairs to equipment other than locomotives and cars.....	204

And, in addition, some 930 shop and casting orders for the repairing of stationary equipment, manufacture of repair parts, and new material.

With the construction work drawing to a close, the general policy has been to gradually reduce the amount of repair parts and other material carried in storehouses, which policy required the mechanical division to handle more and more manufacturing work on short notice. It is estimated that one-third of our manufacturing orders require completion and delivery in from 3 to 10 days after order has been placed.

The handling of over 900 shop orders per month, with one-third of same on short delivery, and the large number of men placed under each foreman, necessitated said foremen being relieved of the detailed duties of deciding upon and procuring the proper material to be used in the manufacture of shop orders.

The planning department, inaugurated during the previous year, was, during the past year, enlarged upon and perfected to meet the requirements of the present work. All shop orders, after being approved by the superintendent, are sent first to this planning department, where drawings (if originated by division engineers) are checked. If no drawings accompany orders, sketches or necessary prints are prepared for shop use. A detailed bill of all necessary material for the completion of order is then prepared and taken to storehouse to ascertain whether such material is in stock. If all required material is not available, arrangements are made for substitutions. All material is then reserved in storehouse for each individual order. Storehouse requisitions, bill of material, drawings, and order are then forwarded to the shop.

This system has proved a very valuable adjunct; in fact, an absolute necessity, to the prompt and efficient handling of the large amount of emergency work being manufactured by this division. With it the foreman is relieved of the necessity for any checking of drawings, the ascertaining of whether material is in stock for the full completion of order, and the writing of storehouse requisitions. He takes up each manufacturing order with the full knowledge that there will be no delay in the procurement of his material, and can consequently devote his entire time to increasing the efficiency of the men under him.

Every order originating in construction divisions has a requested date of delivery on same. When these orders leave planning department and are sent to shops, copies are distributed to the foremen interested and work is immediately begun upon same. A meeting of all foremen is held in the general foreman's office each day at 1.30 p. m. for the checking of all orders overdue and all new orders which have been sent to the shops during the previous day. Each order is taken up by its number and each foreman having any work to perform upon same is called upon to give an estimate of the length of time which order will require in his department. For example, when an order originates in foundry, foundry foreman states the number of days he will require for completion of rough castings; machine shop foreman states length of time he will require for machining of castings; and erecting shop foreman gives time limit for erection and completion of order; the date is then set for shipment. If shipment date does not correspond with or fall earlier than the requested completion date of division engineer, notice is immediately sent to main office that an extension of time is required, and division engineer is so notified. This system gives to all construction officials a knowledge of when they may expect the completion of either manufactured or repaired work sent into these shops.

After a year's operation, with the handling of over 900 orders per month, it has been found that from 75 to 80 per cent of these orders are completed on the dates set in these foremen's meetings; that the other 20 to 25 per cent are completed within from two to three days after the date set. Orders can be handled in these foremen's meet-

ings at the rate of about 1 every 40 seconds. The speed with which these orders are handled through foremen's meetings is due to foremen being allowed a full day to familiarize themselves with the orders before they are taken up in meetings, and the accuracy of the dates set is largely due to there being no delays in the procurement of material for the manufacture of the order.

While our planning department and shop system embodies some of the principal features of the various efficiency systems now being inaugurated throughout the United States, the nature of our work (largely repairing) and the variety of same has made it impracticable to carry out these efficiency systems any further than we have done. In addition we have been careful to not allow the overhead expenses incurred by such efficiency systems to destroy or eat up the benefits derived from increased shop efficiency.

The cost of articles manufactured in these shops has in many instances been lower than we are able to purchase the same items in the United States, notwithstanding the fact of our higher price of labor, vacation, sick and injury leave, etc.

The cost of repairs per unit of rolling equipment has increased during the past year, due to the age and deterioration of such equipment. For example, during the year 1910-11 this division renewed 4,109 boiler flues in all classes of locomotives; during the past year, 23,616.

The organization of the mechanical division on June 30, 1912, was made up as follows: Superintendent, A. L. Robinson; chief clerk, William Taylor; mechanical engineer, Henry Schoellhorn; electrical superintendent, Hartley Rowe; chief draftsman, C. E. Whipple; testing engineer, Q. A. Hall.

A summary of the operations of the different departments follows.

GORGONA SHOPS.

While additions and improvements have been made in the system and supervision of work in Gorgona shops during the past year, very few additions to buildings or new installations of machinery have been undertaken, it being assumed that the life of these shops would not extend beyond the middle of 1913. The additions to plant and improvements to buildings throughout the past year are as follows:

LOCOMOTIVE DEPARTMENT.

[General foreman in charge, Mr. J. J. Eason.]

PIPE AND TIN SHOP.

Two additional pipe cutting and threading machines, one 8-inch and one 12-inch, were installed.

FOUNDRY AND PATTERN STORAGE.

The repair of all classes of rolling and construction equipment has necessitated the carrying in stock of a large number of steel castings, in that the average length of time to procure one of these repair parts from the United States has been from three to five months. In order to reduce the amount of this stock before the close of construction work, it was decided to install in foundry all necessary

equipment for the manufacture of steel castings. A Tropenas 2-ton converter, blower, sand grinder, and all necessary apparatus, including an oven for drying molds, was purchased and put in operation February 1, 1912. Between February 1, 1912, and June 30, 1912, some 200,000 pounds of steel castings have been manufactured. In addition to this equipment enabling a large reduction in the stock of steel castings carried in storehouses, it is assumed that the same equipment will be an absolute necessity in the new permanent shops.

No additions were made to the pattern storage, except the installation of additional fire protection in the shape of an air alarm.

CAR DEPARTMENT.

[General foreman in charge, Mr. J. Belt; chief car inspector, Mr. William G. Hull.]

PLANING MILL.

The horizontal compound engine, inherited from the French, operating this shop had to be condemned and was replaced with a stationary engine removed from Lirio planing mill, which engine was supplemented with a 50-horsepower motor removed from machine shop.

The only additional new machines installed in planing mill were one planer from Lirio planing mill, and one 24-inch Fay & Eagan planer and one molding machine from Cristobal shops.

CAR SHOPS.

A swing cut-off saw was transferred from Empire and installed in these shops for the cutting up into engine wood of all scrap lumber removed from cars.

PAINT SHOP.

The only additional equipment in this shop consists of an acid bath, steam table, drying ovens, etc., for the cleaning of brass equipment for Panama Railroad coaches.

ENGINE HOUSES.

The engine houses and repair shops operated by this division at outside points are as follows:

Pedro Miguel engine house: General foreman in charge, Mr. G. J. Gunn.

Gatun engine house: General foreman in charge, Mr. C. S. Perry.

Las Cascadas engine house: General foreman in charge, Mr. J. M. Abston.

Gamboa engine house: Foreman in charge, Mr. Robert Bailey.

Gold Hill engine house: Foreman in charge, Mr. J. A. O'Connor.

The gradual completion of construction work between Bas Obispo and Empire has during the past year decreased the number of units of equipment handled at both Las Cascadas and Gamboa, but a corresponding increase has occurred at Pedro Miguel engine house, which handles all equipment operating on south end of central division, as well as all the equipment of the Pacific division.

The work of removing material from top of slides on Gold Hill side of cut required the hostling of an average of from 12 to 15

engines at that point each night. No engine house was built, but a temporary repair shop and storehouse, consisting of two old box cars, together with the necessary storage and cleaning tracks, etc., were installed.

The Cocoli steel car repair yards on Pacific division were closed, all of this work being concentrated at Pedro Miguel.

At the close of the last fiscal year the Gatun machine and repair shop had been temporarily transferred from the Atlantic to the mechanical division to ascertain whether such transfer would not result in decreased overhead charges and more efficient operation. After a four months' trial these shops were permanently transferred to the mechanical division.

Both the Pedro Miguel and Gatun shops have had their work largely increased during the past fiscal year by being called upon to perform work for the first division in connection with the installation of lock-gate machinery.

The number of pieces of equipment hosted at these outlying engine houses during the past year is as follows:

Total hostlings to all equipment-----	94,344
Total labor cost -----	\$89,880.26
Total material cost -----	16,397.30
Total -----	106,277.56

The average direct labor cost during the year for all hostlings was \$0.9517, as against \$0.9775 for the previous year.

MECHANICAL ENGINEER'S DEPARTMENT.

The mechanical engineer has under his supervision the work of the chief draftsman, testing engineer, boiler inspectors, material inspector, and requisition clerk, and, in addition to outlining and directing their work, prepares all specifications covering special requisitions for material and equipment for this division, acts in a consulting capacity on committees with engineers of other divisions when called upon, and, as chairman of the committee on standard specifications, prepares and submits specifications covering all standard material purchased by the commission. During the past year 50 of these standard specifications have been revised and submitted.

CHIEF DRAFTSMAN.

The chief draftsman, in charge of the planning department and all drafting, has had full jurisdiction over the extension of the planning department which has taken place during the past year. This department, as outlined above, is much more comprehensive in its scope, and prepares bills of material for all manufacturing work, including wood parts for car repairs. The whole system has been so developed and adapted to the needs of the shops that the economy and facility with which manufacturing work is handled is greatly increased.

During the past year this department has handled some 11,396 manufacturing orders, 2,933 of which were casting orders on foundry. This is an increase of about 75 per cent over the number of orders handled during the preceding year.

In the drafting room there has been prepared over 1,000 drawings and sketches, while 542 foreign drawings have been filed and indexed. Also, 1,380 pattern numbers have been issued and recorded.

All invoices of manufactured products covering more than one item have been referred to the drafting room for unit prices, and all invoices covering standard repair parts have been checked.

The drafting room has also prepared during the past year a complete inventory, with detailed description—including original price, present condition, estimated value, etc.—of all machine tools on the Isthmus and all rolling equipment. It has also prepared ground plans for the permanent shop buildings at Balboa, together with all machine locations in such shops.

TESTING DEPARTMENT.

The equipment of this department has been increased during the past year by all necessary apparatus for the complete analysis of samples taken from each steel blow made in these shops. A testing machine of 100,000 pounds capacity has been ordered and will be installed in this department for the obtaining of breaking, yield point, and tensile strength of all metals manufactured.

The work of the department during the past year has, in the main, consisted of the analyses of steel, brass, babbitt metals, coal, and lubricating and fuel oil samples.

During the fiscal year, 1,206 tests and analyses have been completed, covering all classes of material and equipment. In addition, tests were made and records obtained of cutting speeds used in machine shop, with a view of increasing such speeds and the obtaining of greater efficiency for machines. Tests have been made of the air flow and air consumption of various divisions from compressed-air plants.

BOILER-INSPECTION SERVICE.

The boiler-inspection rules and regulations were revised during the past year by a committee appointed by you, said rules and regulations submitted by the committee being approved under Circular No. 239-A, and becoming effective September 1, 1911. The work of this department during the past year may be summarized as follows:

	Number.
Boilers visited.....	4, 028
Internal inspections.....	1, 213
Boilers tested by hydrostatic pressure.....	730
Boilers condemned.....	10

Some 1,670 recommendations were made to the heads of departments.

It is to be noted that while the commission has in service over 4,000 steam boilers, no boiler explosion of any moment has ever taken place on the Isthmus. It is believed that the efficiency of this inspection service is responsible for the above result.

ELECTRIC-LIGHT AND AIR-COMPRESSOR SUBDIVISION.

This division, under the supervision of Electrical Supt. Hartley Rowe, has continued the operation and maintenance of the air-compressor plants at Las Cascadas, Empire, Rio Grande, and Balboa;

the operation and maintenance of the electric power and lighting plants at Cristobal, Gorgona, Empire, and Balboa; the wiring and maintenance of all lighting systems in commission buildings; the installation of motors and other electrical equipment for other divisions; also, repairs to galvanometers and blasting batteries used by all construction divisions.

The above work includes the maintenance of some 50 miles of pole line, carrying 146 miles of overhead wires, distributing current for the operation of about 40,000 lamps and 600 horsepower in motors.

The output of all electric-light plants operated by this division for the year was 5,041,303 kilowatt hours, which, with 2,204,801 kilowatt hours furnished by the construction divisions to this division for distribution, makes a total of 7,246,104 kilowatt hours distributed and billed by this division.

The combined output of all air-compressor plants operated by this division for the year was 8,795,157,453 cubic feet of free air at 70° F., which air was compressed and distributed at 100 pounds pressure, at an average cost for the year of \$0.0312 per thousand cubic feet. The largest monthly output during any of the past 12 months was 828,464,858 cubic feet.

The increased construction work on the Pacific division and the decrease of construction work on the north end of the central division increased the air consumption around Pedro Miguel and Miraflores to such an extent as to necessitate the removal from the Las Cascadas plant, and installation in the Aguadulce pumping plant of the Pacific division of two 2,200-foot Ingersoll-Rand compressors, with necessary boilers, pumps, etc.

Detailed statements of the operation of this branch of the mechanical division are given in exhibits marked "E" and "F," attached.

The attached data sheets, lettered from "A" to "J," inclusive, give an abstract of the principal operations of the mechanical division during the past year.

Exhibit A. Abstract of expenditures.

Exhibit B. Number and class of repairs to all locomotives and cost of same.

Exhibit C. Number and class of repairs to all cars and cost of same.

Exhibit D. Operation of iron, brass, and steel foundries for the year.

Exhibit E. Output of air-compressor plants, with cost for each month of the year.

Exhibit F. Operation of electric-light plants.

Exhibit G. Number of repairs made to all classes of equipment other than locomotives and cars.

Exhibit H. Statement of all equipment hosted and cost per month, and average cost per year.

Exhibit I. Number of employees on rolls at close of each month for fiscal year 1911-12.

Exhibit J. Statement showing percentage of overhead expense by months and average for fiscal year 1911-12.

Respectfully submitted.

A. L. ROBINSON,
Superintendent Mechanical Division.

Col. GEORGE W. GOETHALS, United States Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

MECHANICAL DIVISION—EXHIBITS ACCOMPANYING ANNUAL STATEMENT.

EXHIBIT A.—*Abstract of expenditures, 1911-12.*

Month.	Labor.	Material.	O. D. service.	Total.
1911.				
July.....	\$165,614.82	\$116,997.16	\$8,332.83	\$290,944.81
August.....	170,283.22	127,868.93	10,482.22	308,634.37
September.....	165,996.28	130,408.29	10,081.92	306,486.49
October.....	173,508.89	143,782.34	9,901.12	327,192.35
November.....	172,117.62	130,373.94	10,840.94	313,332.50
December.....	178,449.57	144,789.56	10,887.50	334,126.63
1912.				
January.....	190,274.15	143,957.71	11,356.75	345,588.61
February.....	185,671.04	141,834.08	11,104.83	338,609.95
March.....	192,923.00	159,209.39	12,179.88	364,312.27
April.....	177,717.43	151,883.79	10,103.37	339,704.59
May.....	174,338.00	146,651.56	10,697.45	331,687.01
June.....	170,609.63	135,299.68	11,401.31	317,310.62
Total.....	2,117,503.65	1,673,056.43	127,370.12	3,917,930.20
Average per month.....	176,458.64	139,421.37	10,614.18	326,494.19

EXHIBIT B.—*Number of repairs to locomotives, 1911-12.*

Month.	Running repairs.	Heavy or general repairs.	Total.
1911.			
July.....	2,933	15	2,948
August.....	3,179	10	3,189
September.....	2,129	13	2,142
October.....	3,515	15	3,530
November.....	3,049	17	3,066
December.....	3,392	15	3,407
1912.			
January.....	3,538	20	3,558
February.....	3,047	21	3,068
March.....	3,252	12	3,264
April.....	3,163	20	3,183
May.....	3,175	18	3,193
June.....	2,825	34	2,859
Total.....	37,197	210	37,407

	Labor.	Material.	Total.
Cost of repairs to locomotives.....	\$367,749.83	\$150,496.72	\$518,246.55
Average cost per month.....	30,645.82	12,541.39	43,187.21
310 locomotives in service; average cost per locomotive.....	1,186.29	485.47	1,671.76

EXHIBIT C.—*Number of repairs to all classes of cars, 1911-12.*

Class of car.	Shop. ¹	Field.	Total.
40-ton flats.....	15,554	100,597	116,151
Western dumps.....	2,676	52,185	54,861
Oliver dumps.....	2,499	43,714	46,213
Goodwin dumps.....	53	52	105
Ingoldsby dumps.....	26	106	132
Steel flats.....	326	1,492	1,818
Labor cars.....	186	294	480
Miscellaneous.....	241	5,101	5,342
Total.....	21,561	203,541	225,102

¹ Includes Pedro Miguel shop repairs.

EXHIBIT D (a).—Operation of brass foundry, 1911-12.

Month.	Output.	Cost.	Patterns made.	Number of castings.
<i>Pounds.</i>				
1911.				
July.....	518,990	\$0.03280	120	18,238
August.....	765,468	.02610	128	18,274
September.....	633,843 $\frac{1}{2}$	.02820	99	17,524
October.....	768,671 $\frac{1}{2}$	.02274	105	15,479
November.....	711,501 $\frac{1}{2}$	.02359	115	14,633
December.....	653,297 $\frac{1}{2}$	.02809	162	13,801
1912.				
January.....	518,621 $\frac{1}{2}$	.03336	84	20,352
February.....	615,040	.02692	74	21,564
March.....	675,366 $\frac{1}{2}$	.02949	85	24,225
April.....	561,620 $\frac{1}{2}$	.01823	79	26,052
May.....	569,087 $\frac{1}{2}$	.03149	63	17,668
June.....	574,506 $\frac{1}{2}$	.02999	80	4,874
Total.....	7,476,014 $\frac{1}{2}$	.02868	1,194	212,684

EXHIBIT D (b).—Operation of brass foundry, 1911-12.

Month.	Output.	Cost.	Patterns made.	Number of castings.
<i>Pounds.</i>				
1911.				
July.....	29,859 $\frac{1}{2}$	\$0.21690	48	1,519
August.....	15,367 $\frac{1}{2}$	.11930	57	1,463
September.....	19,884 $\frac{1}{2}$	.18042	37	1,186
October.....	19,998 $\frac{1}{2}$	.19698	42	2,283
November.....	24,682 $\frac{1}{2}$	.18200	35	1,890
December.....	26,047 $\frac{1}{2}$	.17300	39	2,220
1912.				
January.....	34,713 $\frac{1}{2}$	.17810	27	2,678
February.....	27,637	.18000	23	1,562
March.....	34,654 $\frac{1}{2}$	.18500	21	1,973
April.....	31,891 $\frac{1}{2}$	.18270	30	1,759
May.....	47,447 $\frac{1}{2}$	.18354	34	2,399
June.....	38,528	.17010	15	1,673
Total.....	350,711 $\frac{1}{2}$	.18110	408	22,605

EXHIBIT D (c).—Operation of steel foundry, 1912.

Month.	Output.	Cost.	Patterns made.	Number of castings.
<i>Pounds.</i>				
1912.				
February.....	24,029	\$0.13460	.....	190
March.....	38,646	.12180	35	618
April.....	40,315	.09897	20	365
May.....	55,197	.10787	30	441
June.....	41,616	.10700	21	380
Total.....	199,803	.11180	106	1,994

EXHIBIT E.—*Operation of air-compressor plants, 1911-12.*

Month.	Cubic feet.	Cost.	Cost per thousand cubic feet.
1911.			
July.....	731,170,775	\$24,603.23	\$0.0337
August.....	797,055,285	25,788.20	.0324
September.....	757,373,790	22,763.43	.0301
October.....	828,464,858	24,484.18	.0295
November.....	784,553,037	22,862.71	.0291
December.....	749,079,920	22,752.48	.0304
1912.			
January.....	775,322,325	22,637.86	.0292
February.....	677,752,768	21,093.85	.0311
March.....	704,874,700	23,082.58	.0327
April.....	665,617,182	21,264.80	.0320
May.....	666,749,703	22,232.38	.0333
June.....	657,143,110	20,808.60	.0317
Total.....	8,795,157,453	274,374.30	.0312

EXHIBIT F.—*Operation of electric-light plants, 1911-12.*

Month.	Kilowatt-hour output.		Total distributed.
	Mechanical division plants.	Gatun and Cristobal plants, Atlantic division.	
1911.			
July.....	398,486	162,881	561,367
August.....	414,244	168,171	582,415
September.....	419,035	174,108	593,143
October.....	444,084	180,073	624,157
November.....	411,742	179,981	591,723
December.....	437,280	181,601	618,881
1912.			
January.....	431,218	191,778	622,996
February.....	412,270	184,510	596,780
March.....	423,803	197,206	621,009
April.....	400,235	182,076	582,311
May.....	405,026	191,634	596,660
June.....	443,880	210,782	654,662
Total.....	5,041,303	2,204,801	7,246,114

The Pacific division, November to June, furnished 74,350 kilowatt hours.

	16-candle-power lights or equivalent.	Arc lights.
June, 1911.....	32,337	187
June, 1912.....	33,272	193

EXHIBIT G.—*Repairs to equipment other than locomotives and cars, 1911-12.*

Month.	Cranes.	Track shifters.	Un-loaders.	Spread-ers.	Locomo-tives, narrow gauge.	Others.	Total.
1911.							
July.....	16	5	140	22	90	21	294
August.....	10	3	122	26	57	14	232
September.....	25	8	121	30	64	73	321
October.....	16	9	123	21	64	22	255
November.....	14	12	127	28	73	19	273
December.....	37	14	131	49	67	14	312
1912.							
January.....	39	15	143	40	74	4	315
February.....	27	15	50	28	26	13	159
March.....	24	14	111	34	15	12	210
April.....	22	8	101	25	7	13	176
May.....	14	4	83	16	4	14	135
June.....	13	6	57	32	5	11	124
Total.....	257	113	1,309	351	546	230	2,806

EXHIBIT H.—*Equipment hosted, cost per month, 1911-12.*

Month.	Number hosted.	Labor.	Material.	Total.	Labor average.
1911.					
July.....	7,816	\$6,724.60	\$381.80	\$7,106.40	\$0.8604
August.....	7,917	7,363.68	576.73	7,940.41	.9301
September.....	7,761	7,559.72	763.42	8,323.14	.9741
October.....	8,077	8,662.71	1,063.40	9,726.11	1.0725
November.....	7,825	8,088.29	1,092.33	9,180.62	1.0337
December.....	7,958	8,069.91	1,008.44	9,078.35	1.0141
1912.					
January.....	8,154	7,803.01	1,115.69	8,918.70	.9570
February.....	7,732	7,877.90	1,717.40	9,595.30	1.0189
March.....	8,289	7,497.87	3,023.54	10,521.41	.9046
April.....	7,934	6,578.97	1,993.25	8,572.22	.8292
May.....	7,624	6,745.33	1,945.77	8,691.10	.8847
June.....	7,257	6,908.27	1,715.53	8,623.80	.9519
Total.....	94,344	\$9,880.26	16,397.30	106,277.56	.9527

Locomotives hosted, 85,198; others, 9,146.

EXHIBIT I.—*Number of employees on pay rolls at close of each month.*

Month.	Gold.	Silver.	Total.
1911.			
July.....	967	1,644	2,611
August.....	1,007	1,732	2,739
September.....	1,021	1,904	2,925
October.....	1,033	1,785	2,818
November.....	995	1,918	2,913
December.....	989	1,950	2,939
1912.			
January.....	984	2,032	3,016
February.....	988	2,175	3,163
March.....	1,018	2,254	3,272
April.....	977	1,969	2,946
May.....	941	1,750	2,691
June.....	935	1,825	2,760
Average.....	988	1,912	2,900

EXHIBIT J.—*Percentage of overhead expense, 1911-12.*

Month.	Per cent.	Month.	Per cent.
1911.		1912.	
July.....	40.25	January.....	39.08
August.....	39.91	February.....	38.16
September.....	35.36	March.....	33.60
October.....	30.79	April.....	39.97
November.....	36.20	May.....	39.32
December.....	35.65	June.....	41.48
		Average.....	37.48

APPENDIX H.

REPORT OF LIEUT. F. MEARS, UNITED STATES ARMY, CHIEF ENGINEER, PANAMA RAILROAD RELOCATION.

PANAMA RAILROAD Co.,
OFFICE OF CHIEF ENGINEER,
Colon, Panama, July 1, 1912.

SIR: I have the honor to submit the following report of operations of the relocation, Panama Railroad, during the fiscal year ending June 30, 1912:

The construction of the relocated line of the Panama Railroad was continued by the engineering department of the Panama Railroad Co. during the entire fiscal year. The department was, unfortunately, denied the services of Mr. H. P. Warren, engineer of construction, who suffered an accident on June 9, 1911, breaking his leg and incapacitating him for further work during the year. I wish to express my appreciation of his former assistance in connection with this project and my regret that his services were thus terminated.

The field work was carried on under charge of Mr. M. B. Connolly, superintendent of construction, with office engineering under the charge of Mr. O. G. Tubby, chief draftsman, Panama Railroad. The office administration and timekeeping has been under charge of the regular office force of the engineering department, with Mr. C. W. Lee as chief clerk. The entire organization is shown on chart. (Plate 125.)

The construction work during the fiscal year to which this report pertains is naturally separated into two divisions, the original line from Gatun to Gamboa, and the Gold Hill line, both of which were completed and turned over to the Panama Railroad Co. during the year.

The small amount of work remaining to be done at the close of the fiscal year consisted of riprapping the submerged embankments through the lake section and installing the bascule bridge at Monte Lirio. The relocation organization was therefore abolished on June 30, 1912, and any further work necessary, properly chargeable to the relocation account, will be accomplished by the maintenance-of-way forces of the Panama Railroad Co., under work request.

ORIGINAL RELOCATED LINE.

MINDI TO GAMBOA.

COMPLETING LARGE EMBANKMENTS, GATUN RIVER SECTION.

At the beginning of the year, construction work was confined to the Gatun Valley section of the line—Gatun to Monte Lirio—and consisted in completing the immense embankment in the Quebrancha,

Brazos, and Baja Bottoms, which have been under construction since January, 1910. These large embankments are described in last year's report of the commission on pages 193 and 194, where it is stated that 850,000 cubic yards were required to complete the line. This figure was exceeded, however, due to the settlement which occurred in the Brazos Bottom, which was not anticipated.

The embankment across the Brazos Bottom, 4,800 feet long, is the largest on the line. While the elevation of the track is the same, the fill itself is not so high as some of the other large embankments in the same district, the natural ground level being at a higher elevation. For this reason there was less weight per square foot, and it was thought the Brazos Bottom might hold up without settlement. Diamond-drill borings had shown the underlying strata of the Brazos Valley to be about the same as the Quebrancha—i. e., solid rock from 150 to 200 feet below the surface of the ground. The intervening material consisted of a top or ground layer of fairly good clay, from 20 to 30 feet thick, with an underlying stratum of soft clay, mixed with decomposed wood and vegetable matter, and a small proportion of fine sand. This soft layer varied from 50 to 100 feet thick. The pressure on this top layer caused this softer mass to move toward the line of least resistance, upheaving the natural ground beyond the toe of slope.

All of these settlements were treated by spreading the base of the fill, in order to counterweight the natural ground and thus prevent upheaval, and also to decrease the weight per square foot upon the natural ground.

The Brazos Bottom fill was nearly completed when the first settlement occurred. (The base of the fill was at that time spread out for a 40-foot roadbed, and side slopes of 1 on 2.) The base was then widened to slope stakes set at 1 on 3 before any further weight was added to the upper level, and when completed there was found to be no further difficulty in bringing the top level to grade.

The settlements which occurred in the other bottoms are described in last year's report and illustrated by accompanying diagrams and photographs. Some further trouble with settlements was encountered with the Quebrancha fill, and also with the Baja fill, but they were fought and conquered on similar lines as described above, it being necessary in these cases to spread the base to a 4 on 1 slope on account of the greater height of fill. It is not to be expected that posterity will generally realize the great amount of yardage necessary to build this short 3-mile section of line through the Gatun Valley. In these 3 miles there have been placed 4,736,072 cubic yards of material, or an average of 1,578,690 cubic yards per mile, all necessary to secure a permanent railroad above the proposed lake level.

These embankments were practically completed by January 1, 1912, but two steam shovels were retained for several weeks to furnish material for riprapping fills, and the last steam shovel was cut out on February 14, 1912.

PERMANENT TRACK.

The work of laying the remaining permanent track was undertaken in December, 1911, and completed, as far as practicable, by February 15, 1912. This track consisted of 90-pound open-hearth steel, 100 per

cent splice bars, and either creosoted or hardwood crossties, fitted with Economy tie plates and screw spikes. The screw spikes in hardwood ties were put down with a machine spike driver, while with the creosoted crossties both the machine spike driver and hand wrenches were used. This track was ballasted with gravel obtained from deposits in the Chagres River.

TURNING OVER COMPLETED LINE TO PANAMA RAILROAD CO.

This section of the line was formally turned over to the Panama Railroad Co. on February 15, 1912, on which date the entire operation of the road was transferred from the old to the new line. The trains operate over this new line east of the canal as far as the north end of Culebra Cut, at which point they switch back across the canal on a construction dike to the old main line, following it north to Gorgona, whence they take the original direction south, over the old route, to Panama. The operation over the new roadbed has been attended with no difficulties, except that in some cases some small slides have occurred along the slopes of the embankments. The work of riprapping the submerged embankments has continued under operation, and the weight of the rock, placed as riprap, has sometimes caused the sides of the fill to slide, necessitating careful work to maintain traffic.

NEW GOLD HILL LINE.

GAMBOA TO PEDRO MIGUEL.

The necessity which called for the construction of a railroad around Gold Hill, is set forth in last year's report on page 195. The so-called Gold Hill Line is $9\frac{3}{8}$ miles in length from the south end of the Chagres River bridge to the junction with operated line at Pedro Miguel. It leaves the 95-ft. east berm of the Culebra Cut, just south of the bridge, and passes around Gold Hill on a high level. The summit is reached near the La Pita divide at +271 above mean sea level, and the Continental Divide is crossed, opposite Culebra, at an elevation of +241 above mean sea level. This line was well under construction at the beginning of the fiscal year and the work progressed to completion in the early part of 1912. The construction of the section of the line, immediately east of Gold Hill, along the Pedro Miguel River to Paraiso, was attended with considerable difficulty in the way of slides. The rock strata, inclined toward the river bed, coupled with the soft, moisture laden ground soil, caused several of the embankments to slide. It was found impossible to build up a stable railroad embankment at one of these points, and the alignment was therefore shifted toward the hill, and the roadbed placed entirely on solid ground. The grading on this line was completed in the month of March, 1912, and construction of permanent track in May, 1912. The line was formally turned over to the Panama Railroad Co. by the Isthmian Canal Commission, on May 25, 1912, and accepted, which transaction completed the delivery of a new railroad, entirely on the east side of the canal, to replace that part of the old Panama Railroad destroyed (or to be destroyed) by canal operations.

PERMANENT TELEGRAPH LINE.

The construction of the telegraph and telephone line was continued during the year, and completed by June 30, 1912. A 40-wire line was constructed, using No. 10 hard drawn copper wire.

STATION BUILDING AND WATER STATION.

A frame station building and section house was erected at the permanent town site of Monte Lirio on the Gatun River, mile 14, and a permanent reenforced concrete water station constructed at the new town site of Frijoles, mile 21.

BASCULE BRIDGE.

The girders for the permanent bridge over the Gatun River at Monte Lirio were made available when the original Panama Railroad was abandoned on February 15, 1912. The work of dismantling the old bridge at Barbacoas was undertaken at once. The three north girder spans were moved to Monte Lirio, and the two shore spans set in place. The center span is to be converted into a balanced lift span to give ships access to the upper arm of Gatun Lake. The award for furnishing the necessary lifting mechanism was made to the Penn Bridge Co., of Beaver Falls, Pa., on April 3, 1912, and complete delivery called for by August 1, 1912. I am reserving a full description of this bridge for next year's annual report, when there will be complete data and drawings available.

PROGRESS PHOTOGRAPHS.

An effort has been made to have the accompanying progress photographs show the completed work in comparison with the progress plates which appear in former reports, as follows:

Plate 62. Quebrancha Bottom, looking north, June, 1911. To correspond to plate 63, 1911 report.

Plate 63. The Brazos Bottom, looking north, June, 1912. To correspond to plate 64, 1911 report.

Plate 64. Gold Hill Line, looking up the Pedro Miguel Valley, June, 1912. To correspond to plate 70, 1911 report.

Plate 65. Gold Hill Line, embankment across deep valley back of Paraiso, 77 feet high, looking south. To correspond to plate 68, 1911 report.

DETAILED STATEMENTS OF QUANTITIES AND EXPENDITURES.

Detailed statements of quantities and expenditures have been prepared, having reference to the fiscal year 1912, as well as to the total to date from the beginning of the work. These appear in the order named on the following pages:

1. Recapitulation, actual charges to account "Relocation of the Panama Railroad," fiscal year 1912.

2. Unit costs for fiscal year 1912.

3. Total charges account "Relocation of the Panama Railroad," September, 1906, to June 30, 1912, showing classified distribution.

4. Unit costs covering all charges, September, 1906, to June 30, 1912.

5. Recapitulation, financial statement.

6. Statement showing total quantities to June 30, 1912, used in the construction of the relocated line.

TABLE 1.—*Actual charges to account "Relocation of the Panama R. R.," fiscal year 1911-1912.*

RECAPITULATION.

Account.	Description.	Gatun-Gamboa Line.	Gold Hill Line.	Grand total.
502	Engineering	\$24,690.87	\$24,210.71	\$48,901.58
505	Grading	531,587.88	575,610.00	1,107,197.88
507	Bridges and culverts	14,738.82	15,015.06	29,753.88
508	Ties	46,449.03	12,980.93	59,429.96
509	Rails	44,940.75	62,305.09	107,245.84
510	Track fastenings	38,002.17	21,359.15	59,361.32
511	Frogs and switches	5,680.83	754.98	6,435.81
512	Ballast	25,003.20	11,429.45	36,432.65
513	Permanent track	112,880.13	19,855.96	132,736.09
515	Crossings, cattle guards, and signs	436.20	108.67	544.87
516	Interlocking and signals	5,262.19	77.94	5,340.13
517	Telegraph and telephone	29,895.50	21,134.55	51,030.05
518	Station buildings and fixtures	4,575.85	.....	4,575.85
521	Water stations	3,398.93	.....	3,398.93
524	Miscellaneous structures	6,562.44	.....	6,562.44
525	General expenses	82.11	3.13	85.24
	Grand total	881,062.02	764,845.62	1,645,907.64

TABLE 2.—Relocation of the Panama Railroad, fiscal year 1911-12.

[Unit costs.]

Account.	Description.	Mindí-Tower and Paraiso-Corozal Line.			Gold Hill Line.		
		Amount.	Quantity.	Unit.	Amount.	Quantity.	Unit.
502	Engineering.....	\$24,690.87			\$24,210.71		
505	Grading.....	531,587.88	1,710,535.00	Cubic yards.	575,610.00	1,498,486.00	Cubic yard.
	Hull contract.....					77,745.00	do.
	Relocation force.....					1,420,741.00	do.
507	Bridges and culverts.....	14,738.82			15,015.06		
	Permanent track accounts 508, 509, 510, 512, and 513:						
	Material.....	152,123.07	72,546.00	Linear feet.	108,074.62	50,917.00	Linear foot.
	Labor.....	89,613.09	72,546.00	do.	18,894.23	50,917.00	do.
	Total.....	241,736.16	72,546.00	do.	126,968.85	50,917.00	do.
	Maintenance permanent track:						
	Material.....	776.54	4.00	Miles.			
	Labor.....	6,186.47	4.00	do.	2,961.73		
	Total Paraiso to Corozal.....	6,963.01	4.00	do.			
	Material.....	1,495.54	23.88	do.			
	Labor.....	17,080.57	23.88	do.			
	Total Gatun to Tower R.....	3 18,576.11	23.88	do.			
511	Frogs and switches.....	5,080.83			754.98		
515	Crossings, signs, etc.....	436.20			108.67		
516	Interlocking and signals.....	5,262.19			77.94		
517	Telegraph and telephones.....	29,895.50	12.40	Miles.	21,134.55	9.39	Miles.
518	Station buildings and fixtures.....	4,575.85					2,250.7500
521	Water stations.....	3,398.93					
524	Miscellaneous structures.....	6,562.44					
525	General expenses.....	82.11			3.13		
	Total.....	881,062.02			764,845.62		

¹ High account relaying 90-pound steel, replacing all ties and picking up old steel and ties.
² Gold Hill Line, 1 month.
³ Unit cost figured for 1 year on basis of charges for 6 months; \$18,576.11 represents 6 months' charges.

TABLE 3.—Actual charges to account "Relocation of the Panama Railroad,"
September, 1906, to June 30, 1912.

Account.	Description.	Mindi-Gam- boa line Paraiso- Corozal.	Gold Hill Line.	Grand total.
502	Engineering.....	\$308,122.61	\$38,296.55	\$346,419.16
503	Right-of-way and station grounds.....	543.05		543.05
504	Real estate.....	72.87		72.87
505	Grading.....	5,497,201.10	934,283.29	6,431,484.39
506	Tunnels.....	186,736.37		186,736.37
507	Bridges and culverts.....	829,592.03	79,761.48	909,353.51
508	Ties.....	99,342.05	12,980.93	112,322.98
509	Rails.....	147,506.78	62,305.09	209,811.87
510	Track fastenings.....	66,734.33	21,359.15	88,093.48
511	Frogs and switches.....	8,892.97	885.31	9,778.28
512	Ballast.....	70,013.88	11,429.45	81,456.33
513	Permanent track.....	232,328.20	19,942.86	252,271.06
514	Right-of-way fences.....	1,177.19		1,177.19
515	Crossings, cattle guards, and signs.....	4,506.13	108.67	4,614.80
516	Interlocking and signals.....	12,307.79	77.94	12,385.73
517	Telegraph and telephones.....	75,655.27	21,134.55	96,789.82
518	Station buildings and fixtures.....	35,819.71		35,819.71
521	Water stations.....	3,398.93		3,398.93
524	Miscellaneous structures.....	2,532.01		2,532.01
525	General expenses.....	1,478.80	39.24	1,518.04
	Grand total.....	7,583,962.07	1,202,604.51	8,786,566.58

TABLE 4.—*Relocation of the Panama Railroad, September, 1906, to June 30, 1912.*

[Unit costs.]

Description.	Mindi-Tower R and Paraiso-Corozal line.				Gold Hill line.			
	Amount.	Quantity.	Unit.	Unit cost.	Amount.	Quantity.	Unit.	Unit cost.
Engineering.....	\$308,122.61				\$38,296.55			
Right of way and station grounds.....	543.05							
Real estate.....	72.87							
Grading.....	5,497,201.10	14,036,693.00	Cubic yards.	\$0.3916	934,283.29	2,368,714.00	Cubic yards.	\$0.3944
Shaw contract.....		3,154.40	do.	.2500				.5700
Hardy contract.....		12,780.00	do.	.5000				.3880
Hull contract.....						77,745.00	Cubic yards.	
Relocation forces.....		14,020,758.60	Cubic yards.	.3915		2,290,969.00	do.	
Tunnels.....	186,736.37							
Bridges and culverts.....	829,592.03	736.00	Linear feet.	253.7188	79,761.48			
Permanent track:								
Material.....	372,553.16	177,504.00	Linear feet.	2.0988	108,074.62	50,917.00	Linear feet.	2.1225
Labor.....	196,984.21	177,504.00	do.	1.1.1097	18,981.13	50,917.00	do.	.3728
Total.....	569,537.37	177,504.00	do.	3.2085	127,055.75	50,917.00	do.	2.4953
Maintenance permanent track:								
Mindi-Gatun, 2 years—								
Material.....	6,817.71	2.60	Per mile, 1 year.	1,311.0900				
Labor.....	5,613.90	2.60	do.	1,079.6000				
Total.....	12,431.61	2.60	do.	2,390.6900				
Paraiso-Corozal, 22 months—								
Material.....	2,730.63	4.00	do.	371.3600				
Labor.....	12,649.52	4.00	do.	1,724.9300				
Total.....	15,380.15	4.00	do.	2,097.2900				
Gatun-Tower R, 6 months—								
Material.....	1,495.54	23.88	do.	125.2400				
Labor.....	17,080.57	23.88	do.	1,430.5400				
Total.....	18,576.11	23.88	do.	1,557.7800				

Tower R.-Pedro Miguel, labor (1 month).			
Frogs and switches.....	8,892.97		961.73
Right-of-way fences.....	1,177.19		885.31
Crossings, cattle guards, signs.....	4,506.13	Linear feet.	
Interlocking and signals.....	12,307.79	1371	
Telegraph and telephone.....	75,655.27		108.67
Station buildings and fixtures.....	35,819.71	Miles.	77.94
Water stations.....	3,398.93	2,482.1200	21,134.55
Miscellaneous structures.....	2,532.01		
General expenses.....	1,478.80		9.39 Miles.
			39.54
Total.....	7,583,962.07		1,202,604.51

¹ High on account of relaying track several times and changing to 90 per cent steel.

TABLE 5.—*Relocation of the Panama Railroad.*

RECAPITULATION, FINANCIAL STATEMENT.

	Mindi-Gamboa and Paraiso-Corozal.		Gold Hill line.		Grand total.	
	Estimated.	Appropriated.	Estimated.	Appropriated.	Estimated.	Appropriated.
Total original estimate.....	\$7,996,978.67	.....	\$1,750,000.00	.....	\$9,746,978.67	.....
Total appropriation, fiscal years 1907 to 1912, inclusive.....		\$7,615,718.67		\$1,750,000.00		\$9,365,718.67
Total.....	7,996,978.67	7,615,718.67	1,750,000.00	1,750,000.00	9,746,978.67	9,365,718.67
Expenditures, fiscal year—						
1906-7.....		168,073.42				168,073.42
1907-8.....		1,460,184.94				1,460,184.94
1908-9.....		1,329,179.77				1,329,179.77
1909-10.....		2,343,268.13				2,343,268.13
1910-11.....		1,402,193.79		437,758.89		1,839,952.68
1911-12.....		881,062.02		764,845.62		1,645,907.64
Total expenditures.....		7,583,962.07		1,202,604.51		8,786,566.58
Balance, original estimate.....	413,016.60	.....	547,395.49	.....	960,412.09	.....
Balance, amount appropriated.....		31,756.60		547,395.49		579,152.09
Balance.....	413,016.60	31,756.60	547,395.49	¹ 547,395.49	960,412.09	579,152.09

¹ Includes about \$100,000 worth of track material taken from relocated line Gatun to Gamboa used on Gold Hill line. This amount has not been credited to appropriation Mindi-Gamboa.

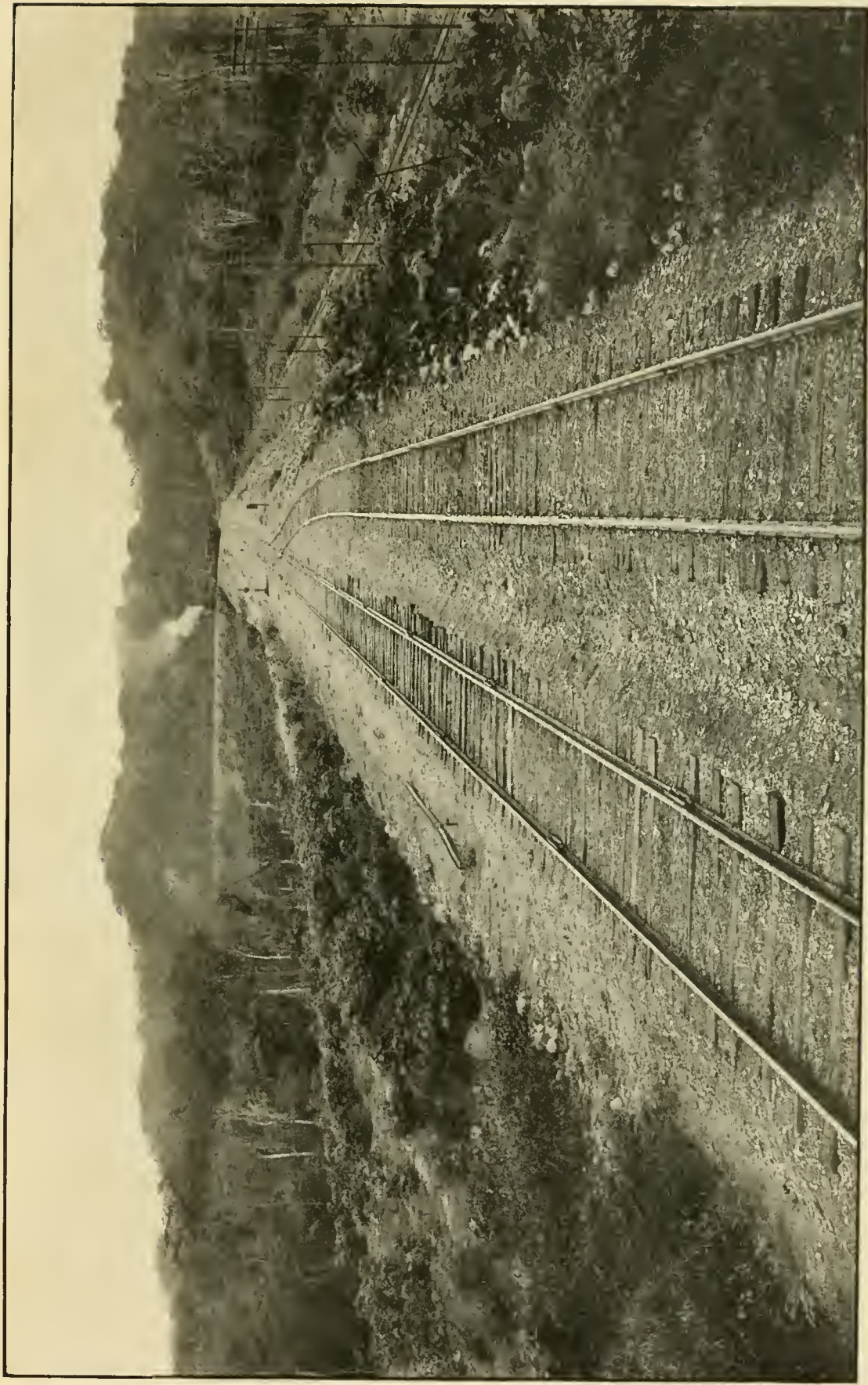
TABLE 6.—Statement showing total quantities to June 30, 1912, used in construction of the relocation of the Panama Railroad.

Description.	Unit.	Mindi-Gamboia line.	Gold Hill line.
Clearing.....	Aeres.....	1,182.22	259.93
Earth excavation.....	Cubic yards.....	2,040,276.00	1,168,511.00
Loose rock excavation.....	do.....	331,978.00	149,609.00
Solid rock excavation.....	do.....	1,580,933.00	581,062.00
Borrow.....	do.....	4,211,131.00	116,331.00
Wet earth.....	do.....	2,212.00	455.00
Spoil from canal.....	do.....	5,198,808.00	73,430.00
Concrete:			
Class A.....	do.....	7,069.07	.....
Class B.....	do.....	38,601.10	5,847.04
Class C.....	do.....	7,944.18	3,661.02
Rubble in cement.....	do.....	52.70	235.17
Rubble, dry.....	do.....	60.00	1,480.00
Riprap.....	do.....	95,146.00	.....
Reinforcing iron.....	Tons.....	2,598.15	643.15
Grillage piles.....	Linear feet.....	103,825.00	11,265.00
Lumber.....	Thousand feet b. m.	¹ 4,148.52	¹ 61.30
Piles.....	Linear feet.....	¹ 1,026,208.00	¹ 194,910.00
Lumber.....	Thousand feet b. m.	² 1,403.00	.....
Piles.....	Linear feet.....	² 2,520.00	.....
30-pound rails.....	do.....	¹ 1,554.00	.....
Ties, 6 by 8 by 8.....	Number.....	¹ 47,587.00	¹ 33,463.00
56, 70, and 90 pound rails.....	Linear feet.....	157,332.00	¹ 24,501.00
Ballast, permanent.....	Cubic yards.....	83,103.00	30,475.00
Ties.....	Number.....	² 103,613.00	² 2,815.00
70-pound rails.....	Linear feet.....	² 129,024.00	.....
90-pound rails.....	do.....	² 225,983.00	² 101,833.00
Tile.....	do.....	1,630.00	.....
Cast-iron pipe.....	do.....	1,954.00	240.00
Galvanized-iron pipe.....	do.....	1,745.00	.....
Vitrified clay.....	do.....	9,903.00	1,782.00
Wooden culverts.....	Feet b. m.....	29,125.00	2,430.00
Steel in bridges.....	Tons.....	1,244.25	.....
Miscellaneous structures.....	Feet b. m.....	700,180.00	.....

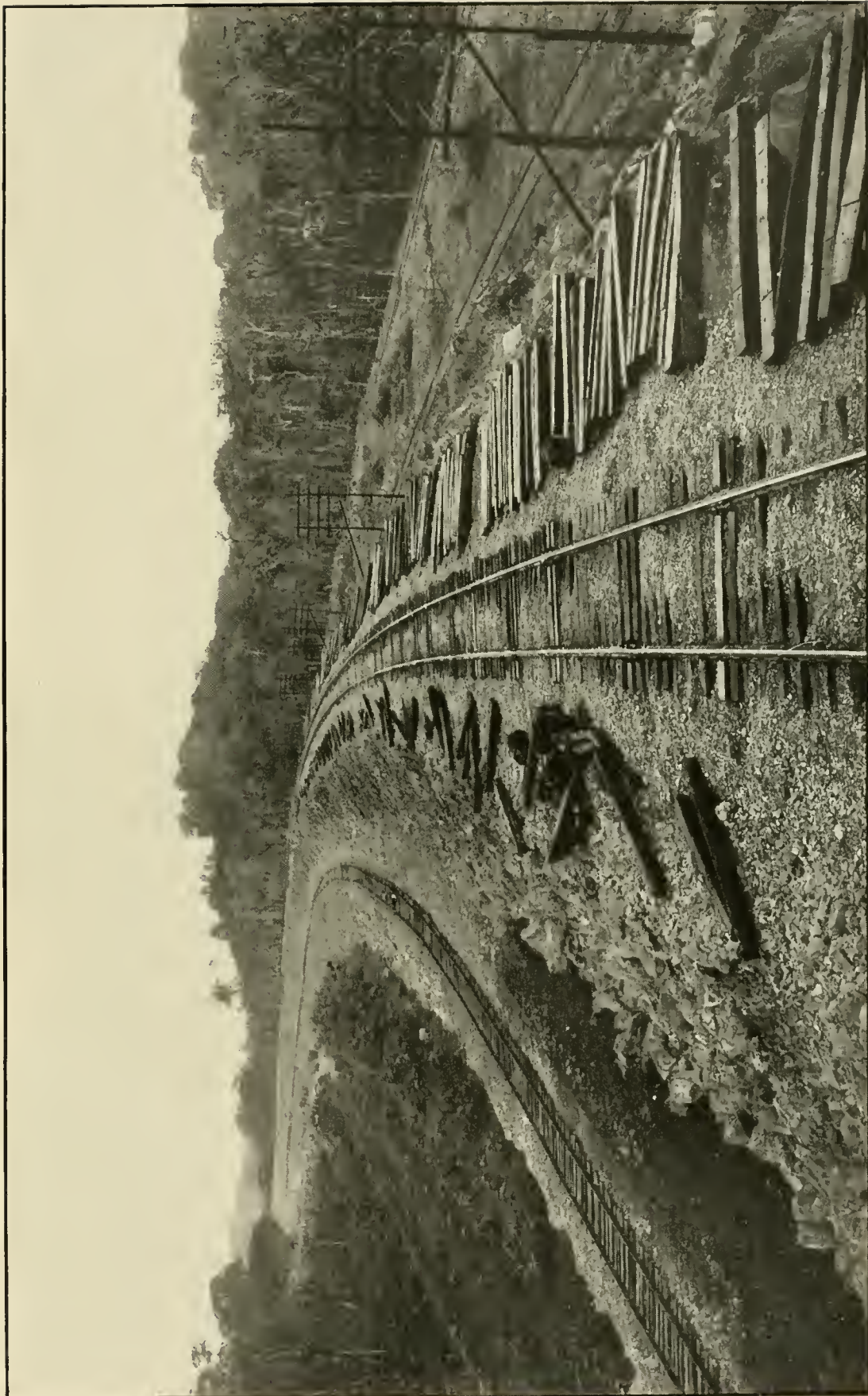
¹ Temporary work.² Permanent work.

Respectfully submitted.

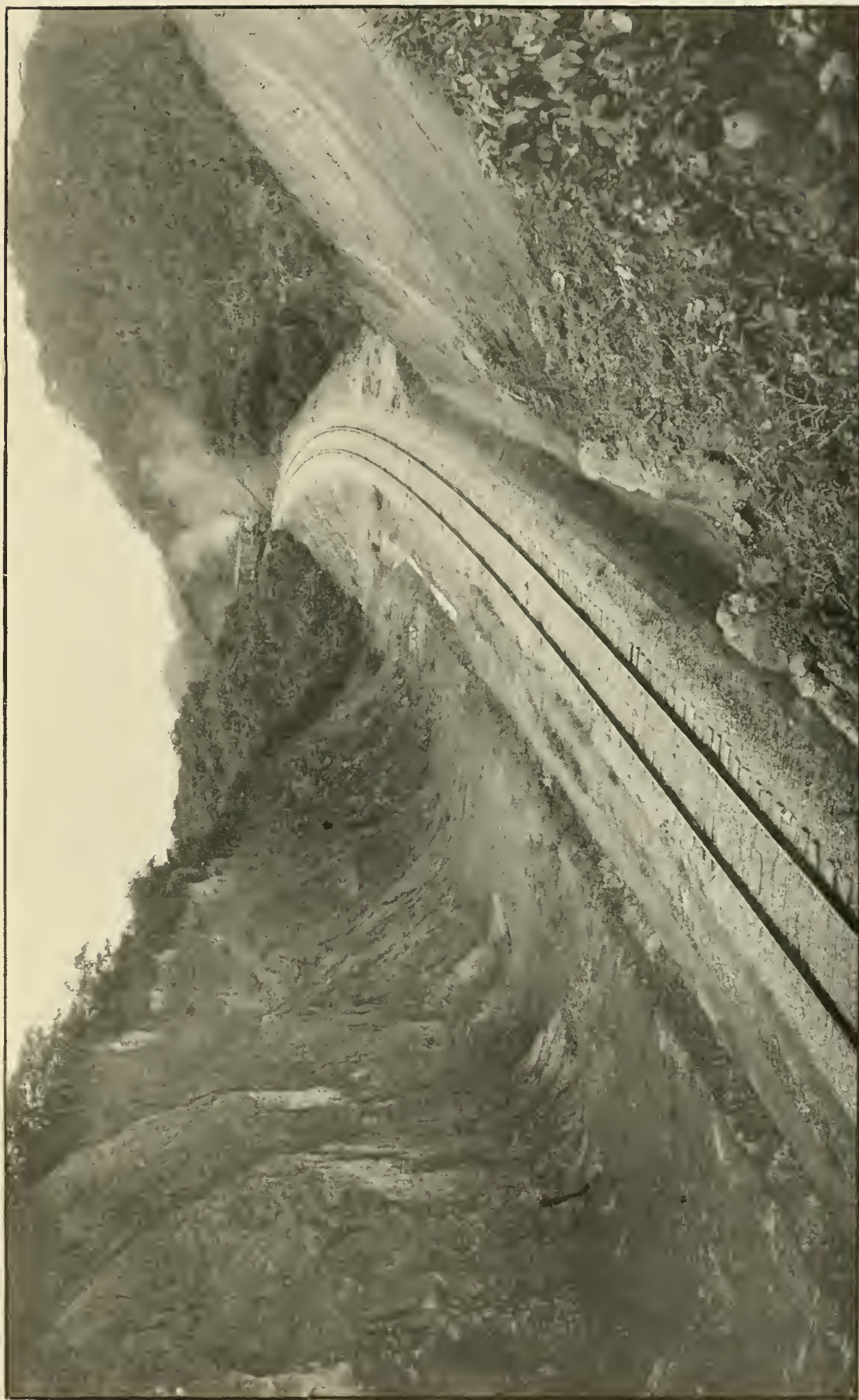
F. MEARS,
Chief Engineer.Col. GEO. W. GOETHALS, U. S. Army,
Chairman and Chief Engineer,
Isthmian Canal Commission,
Culebra, Canal Zone.



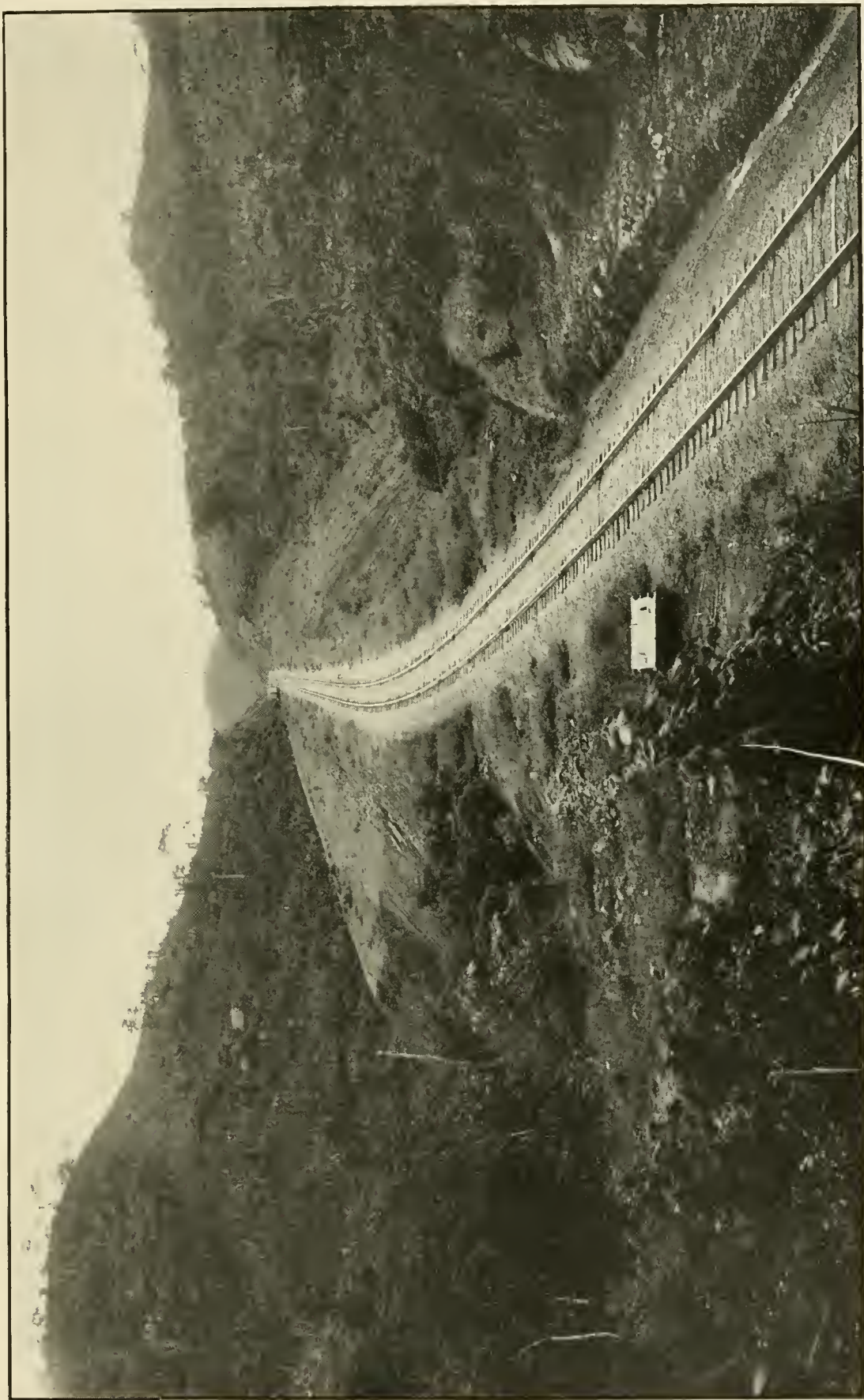
RELOCATION PANAMA RAILROAD. THE QUEBRANCHA BOTTOM, LOOKING NORTH. JUNE, 1912.



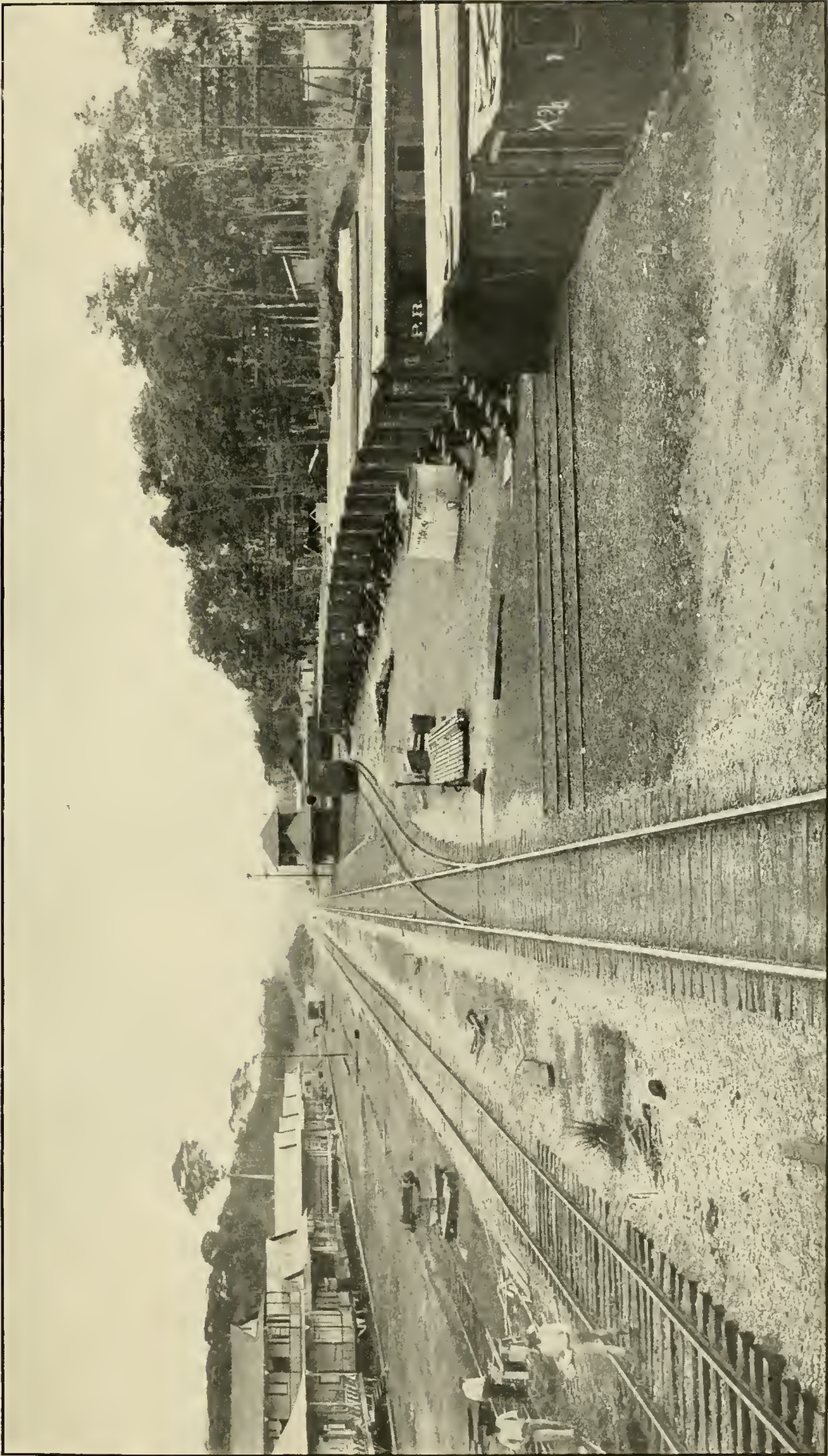
RELOCATION PANAMA RAILROAD. THE BRAZOS BOTTOM, LOOKING NORTH. JUNE, 1912.



RELOCATION PANAMA RAILROAD. GOLD HILL LINE, LOOKING NORTH UP THE PEDRO MIGUEL VALLEY. JUNE, 1912.



RELOCATION PANAMA RAILROAD. GOLD HILL' LINE, LOOKING SOUTH ACROSS DEEP VALLEY EAST OF PARAISO. JUNE, 1912.



RELOCATION PANAMA RAILROAD, NEW TOWN OF MONTE LIRIO, LOOKING NORTH. JUNE, 1912.

APPENDIX I.

REPORT OF AD. FAURE, COST-KEEPING ACCOUNTANT IN OFFICE OF CHAIRMAN AND CHIEF ENGINEER.

ISTHMIAN CANAL COMMISSION,
OFFICE OF CHAIRMAN AND CHIEF ENGINEER,
Culebra, Canal Zone, August 31, 1912.

SIR: I have the honor to submit the following report of the work of this office for the fiscal year 1912.

Cost accounts were established for the construction of the terminal facilities at Balboa, the fortifications, the new Hotel Washington at Colon, and the installation of the locks-operating machinery. In addition to the duties described in the last annual report, this office has taken charge of the preparation of the cost data for the construction of the fortifications; which, together with the supervision given the accounts for the construction of the docks at Cristobal, and the new Hotel Washington at Colon, has greatly increased its work. Cost data for the construction of the fortifications for this fiscal year has been furnished the assistant engineer in charge for incorporation in his report; and that for the construction of the docks at Cristobal and the new Hotel Washington to the chief engineer of the Panama Railroad Co., and is not transmitted with this report, which deals solely with expenditures from the appropriations for the construction of the Isthmian Canal. During the year, there has been no change in the cost-keeping system described in previous report. Notwithstanding the increased duties assigned this office, there has been no increase in the expense or force during the year.

It is of interest to note the cost to the commission of securing and preparing the detailed cost data which is now available. The expenses for the month of June, 1912, were:

Atlantic division.....	\$1,162. 50
Central division.....	800. 00
Pacific division.....	1,487. 97
Mechanical division.....	1,092. 88
Supervision, Culebra office.....	550. 00
Total.....	5,093. 35

a total per annum of about \$60,000—a small expense when savings which have resulted from securing detailed cost data promptly are considered.

EXHIBIT A.—STATEMENTS OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912.

These statements show the total expended to June 30, 1912, for the actual construction of the canal, segregated by construction divisions and by units of work, and the division cost (including plant

and equipment), and general expenses. The total by divisions follows:

Division.	Division cost.		General expenses.		Total.	
	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Atlantic.....	\$40,632,571.68	29.11	\$3,240,075.03	25.49	\$43,872,646.71	28.81
Central.....	69,330,107.07	49.67	7,233,965.49	56.91	76,564,072.56	50.27
Pacific.....	29,485,718.61	21.12	2,225,576.34	17.51	31,711,294.95	20.82
Lights and buoys.....	138,653.70	.10	11,574.84	.09	150,228.54	.10
Total.....	139,587,051.06	100.00	12,711,191.70	100.00	152,298,242.76	100.00

The construction divisions have but remote control over the "General expenses," details of which are shown under Exhibit D, and all comment on costs is based on the "Division cost." It was decided, however, to prorate such expenses to the construction divisions. The following table shows, by periods, the percentage of surcharge over "Division cost" which has resulted from this method:

Divisions.	To June 30, 1909.	Fiscal year—			Total.
		1910	1911	1912	
Atlantic.....	13.34	8.07	6.74	6.70	8.23
Central.....	12.30	9.54	7.78	7.07	10.45
Pacific.....	10.99	9.76	7.76	6.07	8.16
Lights and buoys.....			19.23	9.04	10.12
Total.....	12.27	9.08	7.36	6.61	9.35

EXHIBIT B.—DETAILED COST PER UNIT OF WORK.

TABLE NO. 1.—DRY EXCAVATION.

The quantities and average division cost of dry excavation during the fiscal years 1912 and 1911 were:

Nature of work and location.	1912		1911	
	Quantities.	Average division cost.	Quantities.	Average division cost.
Excavation in canal prism:	<i>Cubic yards.</i>		<i>Cubic yards.</i>	
Atlantic division.....	424,872	\$0.5952	280,305	\$0.6010
Central division—				
By division forces.....	16,917,662	.5115	18,344,424	.5902
By contractors.....	145,784	.3494	178,268	.3600
Total.....	17,063,446	.5101	18,522,692	.5880
Pacific division.....	864,475	.7527	198,770	.6960
Excavation in spillways, dams, locks, etc.:				
Gatun spillway.....			125,383	.4069
Gatun Locks.....			475,875	.7110
Gatun power house.....	72,119	.3767		
Pedro Miguel Dam.....	3,937	1.5026		
Pedro Miguel Locks.....	95,156	.3018	16,423	.5991
Miraflores Locks.....	624,747	.6566	247,700	.7378
Preparing foundations for masonry:				
Gatun spillway.....	7,123	2.6400	32,245	1.5048
Gatun Locks.....	8,888	2.9598	152,582	1.5540
Pedro Miguel Locks.....	38,826	2.1715	76,847	2.3746
Miraflores Locks.....	165,145	1.5677	137,752	1.6085

In the last annual report the low cost of excavation in the central division was commented on, and it was stated that the division cost of \$0.5880 was not likely to be repeated. The cost for this year is \$0.5101, a decrease of \$0.0779, which is largely due to a credit in June, 1912, of \$96,347.25 to "Dumps," representing the excess cost of dumping material at the Naos Island Breakwater from October, 1908, to June 1, 1912, distributed by fiscal years as follows:

1909.....	\$19,995.61
1910.....	29,508.43
1911.....	27,528.77
1912.....	19,314.44
Total.....	96,347.25

Applying these credits to the periods in which they belong results in the following division costs instead of those shown in the preceding table and in Exhibit A:

To June 30, 1909.....	\$0.9155
Fiscal year 1910.....	.6682
Fiscal year 1911.....	.5865
Fiscal year 1912.....	.5147

Owing to the large increase in estimated yardage, the average arbitrary charged for plant during the year was reduced by \$0.0606, so that the division cost, exclusive of arbitrary, was \$0.4865 last year, as against \$0.4753 this year, an actual decrease of \$0.0112. This decrease is entirely in item "Tracks," which shows a decrease of about \$360,000, due principally to excessive dry season, decrease in track mileage, and to recovery of second-hand material from tracks in completed sections of the canal. Other items of expense show but small fluctuations from last year's figures.

TABLE NO. 2.—DREDGING EXCAVATIONS.

The dredges in service, quantities dredged, and average division cost for operation and repairs, during the fiscal years 1912 and 1911, were:

Class of dredge.	1912			1911		
	Number.	Quantity dredged.	Average cost per cubic yard for operation and repair.	Number.	Quantity dredged.	Average cost per cubic yard for operation and repair.
Atlantic division:		<i>Cubic yards.</i>			<i>Cubic yards.</i>	
Seagoing suction.....	1	2,755,255	\$0.0637	1	3,180,196	\$0.0452
Dipper.....	2	595,667	.2548	2	590,448	.1346
French ladder.....	2	1,004,118	.1562	3	1,221,092	.1496
Pipe-line suction.....	2			1		
In prism.....		515,787	.1129		836,569	.0818
In Gatun Locks.....		883,918	.1749			
Pacific division:						
Seagoing suction.....	1	2,376,505	.0732	1	2,904,435	.0569
Dipper.....	1	362,164	.2143	1	738,139	.1371
French ladder.....	3	991,992	.1103	3	1,907,068	.0963
5-yard ladder.....	1	153,626	.2272			

In the Atlantic division during this fiscal year the average cost per cubic yard for pipe lines in connection with the pipe-line suction dredges was \$0.0127 for dredging in prism and \$0.0121 for dredging in locks, as against \$0.0074 for dredging in prism last year. The charge to retaining dikes amounted to \$0.0125 per cubic yard of material excavated from prism and to \$0.0323 per cubic yard of material excavated from Gatun Locks, as against \$0.0729 per cubic yard of material excavated from prism last year. This reduction is largely fictitious, as the larger proportion of cost of the retaining dike, which will be used to hold this class of excavation, was included in the accounts of last year; and the average cost should be based on the quantity dredged to date, both in the prism and in the lock site, a total of 2,236,274 yards, or a cost for the dike per cubic yard of \$0.0429. These costs represent the expenses for disposing of material excavated by pipe-line suction dredges.

The cost of disposing of material excavated by ladder and dipper dredges was: Atlantic division, \$0.1509 per cubic yard, as against \$0.1355 last year; Pacific division, \$0.0907 per cubic yard, as against \$0.0917 last year. In the Atlantic division 574,837 cubic yards of rock were dredged from prism, being 11.80 per cent of total prism excavation. The cost of breaking this rock for the dredges was \$0.2218 per cubic yard. Last year there was excavated 487,038 cubic yards of rock, being 8.36 per cent of total excavation, with a cost of \$0.1588 per cubic yard for breaking. In the Pacific division 410,216 cubic yards of rock were dredged from prism, being 10.56 per cent of total. The cost of breaking this rock for the dredges was \$0.3300 per cubic yard, as against 301,112 cubic yards, being 5.43 per cent of total, and cost of \$0.5776 per cubic yard for breaking last year. The total quantity of material excavated by and the division cost per cubic yard for all dredges, including auxiliary expenses, was:

Atlantic division.—In prism, 4,870,827 cubic yards, average cost \$0.2481; in Gatun Locks, 883,918 cubic yards, average cost \$0.3129; as against 5,828,345 cubic yards in prism, average cost \$0.2215 last year.

Pacific division.—In prism, 3,884,287 cubic yards, average cost \$0.1900; as against 5,549,642 cubic yards, average cost \$0.2519 last year. Figures for the Pacific division do not include any arbitrary for plant, the total cost of the plant having been absorbed prior to this fiscal year. The arbitrary in the Atlantic division was \$0.0458 for excavation in prism and \$0.0880 for excavation in Gatun Locks this year. The arbitrary charged in Pacific division accounts in 1911 was \$0.0759 per cubic yard.

Only two French dipper dredges were operated in the Atlantic division this year, one having been lost in June, 1911. In the Pacific division the 5-yard dipper dredge was put in commission on April 11. The high cost per cubic yard of excavation by this dredge was largely due to the depth at which it worked and the quality of material handled—rock and hard clay. In general, all costs show actual increase, due to increased depth of excavation and longer haul to dumps.

TABLE NO. 3.—HYDRAULIC EXCAVATION.

In the Atlantic division 1,000 cubic yards of material were sluiced from prism at Mindi, at a division cost of \$2.5976 per cubic yard, completing the work described in last annual report. In all, 29,605

cubic yards were removed by this method, at a division cost of \$0.3485 per cubic yard.

In the Pacific division 900,596 cubic yards were excavated from prism, at an average division cost of \$0.5564 per cubic yard, as against 332,703 cubic yards from Miraflores Lock site and 197,677 cubic yards from prism last year, at an average cost of \$0.5486 and \$0.6106 per cubic yard, respectively.

TABLE NO. 4.—MASONRY.

There was a total of 1,443,570 cubic yards of masonry laid in the locks and spillways this year, as against 1,741,908 cubic yards last year. The subjoined table shows location, quantities, kind of concrete, and average division cost per cubic yard for the two years:

Location.	1912		1911	
	Quantities.	Unit cost.	Quantities.	Unit cost.
Atlantic division:				
Gatun spillway—				
Plain concrete.....	<i>Cubic yards.</i> 58,048	\$7.0133	<i>Cubic yards.</i> 59,651	\$6.7044
Reinforced concrete.....	618	15.1631		
Total.....	58,666	7.0988	59,651	6.7044
Gatun Locks—				
Plain concrete.....	390,611	7.1317	902,926	6.5919
Reinforced concrete.....	59,883	11.8228	8,211	12.4487
Total.....	450,494	7.7552	911,137	6.6447
Pacific division:				
Pedro Miguel Locks—				
Plain concrete.....	134,193	5.7183	497,802	4.7040
Reinforced concrete.....	48,677	8.5195	385	17.7426
Total.....	182,870	6.4640	498,187	4.7141
Miraflores Locks—				
Plain concrete.....	729,096	4.5867	272,933	4.6826
Reinforced concrete.....	22,444	10.6388		
Total.....	751,540	4.7675	272,933	4.6826

In addition to the quantity shown, there was used in the installation of tile ducts at Gatun Locks 531 yards of plain concrete. This quantity is included in that reported by division engineer, Atlantic division.

The cost of plain concrete at Gatun spillway, with approximately the same quantity placed, shows an increase over last year of \$0.3089, principally in the following items:

	Per cubic yard.
Sand.....	\$0.3162
Mixing.....	.0468
Forms.....	.1436
Placing.....	.0117
Reinforcements.....	.0362
Pumping.....	.0009
Maintenance of equipment.....	.0622

partially offset by decrease in cement, \$0.1343; stone, \$0.0875; plant arbitrary, \$0.1199; and division expense, \$0.0090, per cubic yard. Owing to the difference in the ratio of large rock used in the two years, the cost of mixed concrete per cubic yard of masonry laid shows fur-

ther increase of \$0.0725, while large rock shows a decrease of \$0.0283 per cubic yard.

With a decrease in quantity laid of 512,315 cubic yards, the cost of plain concrete at Gatun Locks this year shows increase of \$0.5398, as compared with last year, principally in the following items:

	Per cubic yard.
Sand.....	\$0.1514
Mixing.....	.0042
Forms.....	.1710
Placing.....	.1503
Pumps.....	.0461
Power.....	.0168
Plant arbitrary.....	.2011
Division expense.....	.0101

partially offset by decrease in cement, \$0.2452; stone, \$0.1014; and maintenance of equipment, \$0.0248. Owing to the difference in the ratio of large rock used in the two years, the cost of mixed concrete per cubic yard of masonry laid increased \$0.0367 and the cost of large rock decreased \$0.0607. The quantities placed per month have uniformly decreased throughout the year from 64,199 cubic yards in July, 1911, to 1,225 cubic yards in June, 1912. Cost per cubic yard has increased correspondingly to the decreased quantities, having been \$6.2259 per cubic yard in July, 1911, and \$15.9532 per cubic yard in June, 1912. This increase of \$9.7273 per cubic yard appears principally in labor costs of the following items:

	Cubic yard.
Mixing.....	\$0.4024
Forms.....	3.1042
Placing.....	2.7540
Power.....	.3585
Maintenance of equipment.....	1.2609
Division expense.....	.7891

With a decrease in quantity laid of 363,609 cubic yards, the cost of plain concrete at Pedro Miguel locks this year shows increase of \$1.0143, as compared with last year, principally in the following items:

	Cubic yard.
Cement.....	\$0.1199
Mixing.....	.1791
Forms.....	.3250
Placing.....	.2501
Plant arbitrary.....	.2254

partially offset by small decrease in other items. Practically all the concrete laid during the year was handled by the auxiliary plant, the construction plant having been moved to Miraflores, with the exception of two chamber cranes, which were operated until December 12, 1911, and February 7, 1912, respectively.

With an increase in quantity laid of 456,163 cubic yards, the cost of plain concrete at Miraflores locks shows a decrease of \$0.0959, as compared with last year, principally in the following items:

Stone.....	\$0.0668
Sand.....	.0382
Mixing.....	.2968
Forms.....	.0422
Placing.....	.0434
Maintenance of equipment.....	.0143
Division expense.....	.0330

partially offset by increases in cement \$0.3255 and plant arbitrary \$0.1180. The increase in "cement" is due to difference in credit taken in each year for empty bags returned.

The following table shows the division labor cost for the year per cubic yard of plain concrete at the various locks and spillways:

	Gatun spillway.	Gatun locks.	Pedro Miguel locks.	Miraflores locks.
Large rock.....	\$0.0079	\$0.0211		
Forms.....	.5007	.5204	\$0.5511	\$0.3166
Mixing.....	.4543	.1600	.2833	.2011
Placing.....	.2913	.4285	.4731	.1717
Reenforcements.....	.0127	.0158	.0009	.0002
Pumping.....	.0030	.0580	.0237	.0170
Cofferdams.....	.0204			
Maintenance of equipment.....	.1438	.0936	.0546	.0837
Division expense.....	.1084	.0866	.0866	.0491
Total cost per cubic yard.....	1.5425	1.3840	1.4733	.8394

The cost of reenforced concrete is shown in detail in Table No. 4.

TABLE NO. 5.—DRY FILLING.

The quantities of dry fill placed in the various projects and the average division cost per cubic yard for the fiscal years 1911 and 1912 were:

Nature of work and location.	1912		1911	
	Quantities.	Average division cost per cubic yard.	Quantities.	Average division cost per cubic yard.
Atlantic division:				
Gatun Dam.....	2,608,073	\$0.5174	2,653,908	\$0.3813
Gatun spillway back fill.....	10,062	.3898	12,873	.4832
Gatun Locks—				
Back fill.....	922,215	.4615	535,669	.5307
Filling center wall.....	94,574	.7607	2,717	1.0634
Filling around south approach wall.....	7,072	.5092	22,234	.1907
Gatun-Mindi Levee.....			51,156	.1979
Pacific division:				
Pedro Miguel Dam.....	321,589	.5040		
Pedro Miguel Locks—				
Back fill.....	349,275	.3535	273,709	.3900
Filling center wall.....	21,937	.9633		
Miraflores Dam.....	425,125	.4044	295,598	.4102
Miraflores Locks—				
Back fill.....	442,774	.4174	53,521	.4293
Filling center wall.....	7,912	1.0126		

Based on the quantities reported monthly, the cost of dry filling in Gatun Dam shows an increase of \$0.1361 per cubic yard over the last fiscal year. These figures are, however, largely theoretical; for, as explained in the report of the division engineer, Atlantic division, the method of ascertaining the quantity placed each month is to cross section the areas worked over during the month, and deduct an arbitrary of 40,000 cubic yards to allow for slow consolidation in the areas not cross sectioned. Complete cross sections made in June, 1911, and June, 1912, indicate that the dry fill was increased during the fiscal year 1911 by 2,060,186 cubic yards and during the fiscal year 1912 by 2,982,859 cubic yards, instead of by 2,653,908 cubic yards and 2,608,073 cubic yards, respectively.

If the quantities ascertained by the complete cross sections be used, the average cost per cubic yard for the fiscal year 1911 is \$0.4912. Included in the cross section yardage for 1912 are 438,333 cubic yards previously wasted from excavation from Spillway, all cost being charged to that work, but now included in the area of the dam owing to change of plans. The quantity placed by actual measurement was, therefore, 2,544,526 cubic yards, and the division cost \$0.5303 per cubic yard, an increase over 1911 of \$0.0391 per cubic yard.

The quantity of dry fill in place, as ascertained by complete cross section on June 30, 1912, was 9,863,901 cubic yards; the division cost \$4,046,486.38, an average cost of \$0.4102 per cubic yard, instead of \$0.4022 shown on Exhibit A, quantities used on this exhibit being the total of the quantities reported each month.

The average cost per cubic yard for back filling Gatun Lock walls shows a decrease of \$0.0692, principally in "tracks," original cost of installation having been included in the accounts for the fiscal year 1911. The work of filling the center wall of Gatun Locks was commenced in June, 1911, and preparatory work, charged in that month, explains the decrease of \$0.3027 per cubic yard compared with the fiscal year 1912.

Fluctuations in average costs in Pacific division are too small to require explanation.

TABLE NO. 6.—HYDRAULIC FILLING.

The quantity of hydraulic fill placed in Gatun Dam this year, as reported monthly, aggregates 2,604,632 cubic yards, at an average division cost of \$0.3844 per cubic yard, as against 4,256,393 cubic yards, at an average division cost of \$0.2289 per cubic yard last year—an increase of \$0.1555 per cubic yard. For reasons given under "Dry filling," these figures are largely theoretical as the complete cross sections indicate that during the fiscal year 1911, 3,758,870 cubic yards of hydraulic filling were added to the dam, and during the fiscal year 1912, 2,543,086 cubic yards. Using these quantities, the average division cost per cubic yard is \$0.2592 for the fiscal year 1911, and \$0.3938 for the fiscal year 1912, an increased cost per cubic yard of \$0.1346. This increase is general to all items, principally in operation of dredges, \$0.0464; power, \$0.0480; maintenance of equipment, \$0.0174; and plant arbitrary, \$0.0186 per cubic yard. Longer pipe lines and a higher lift account for the first two items of increase, while the increase in "Maintenance of equipment" is due to the harder usage to which the dredges were put, and that in "Plant arbitrary" to decreased estimates of quantities.

Based on actual measurement, the amount of hydraulic fill in place on June 30, 1912, was 9,955,078, and the average division cost \$0.2938 per cubic yard, instead of \$0.2782 shown on Exhibit A, which is based on total of monthly quantities reported.

Hydraulic fill around the south approach wall of Gatun Locks aggregated 594,495 cubic yards, at a division cost of \$0.1545 per cubic yard. The dredge worked in close proximity to the spot where the material was placed with short pipe lines without lift, which explains the low cost per cubic yard as compared with that of the fill placed in the dam.

TABLE NO. 8.—BREAKWATERS.

During the fiscal year 1912, 460,040 cubic yards of material, secured at Point Toro, were placed in the Colon Breakwater, at an average division cost of \$1.3832 per cubic yard, against 359,890 cubic yards last year, at an average division cost of \$1.4506 per cubic yard. Cost of securing fill decreased \$0.4258 per cubic yard as compared with last year, while expense of placing in breakwater, including cost of trestle, increased \$0.2316, and charge for plant \$0.1509 per cubic yard. There was a small decrease in division expenses per cubic yard.

In addition to the fill secured from Point Toro, there were placed in this breakwater 65,133 cubic yards of large stone from Porto Bello, at an average division cost of \$4.3064 per cubic yard, detailed cost of which was:

Quarrying, including loading on barges.....	\$2.7092
Transportation by water to Toro Point.....	.8831
Placing in breakwater.....	.5382
Division expense.....	.1759
Total.....	4.3064

The total of all material placed during the year was 525,173 cubic yards, at an average division cost of \$1.7457 per cubic yard.

Although the Naos Island Breakwater is shown under the reports of the Pacific division, being in the territory embraced by that division, it is being constructed by the central division. The charge made to this account represents the difference between the cost of dumping at the breakwater, including the cost of trestles, and the average cost of disposing of material on dumps at the Pacific entrance of the canal. To June 30, 1912, 782,021 cubic yards of material had been placed, at a cost of \$0.2467 per cubic yard.

TABLE NO. 9.—STONE PRODUCTION.

The quantities of crushed rock produced at the quarries during the fiscal years 1912 and 1911, and the detailed average costs per cubic yard, were:

Items.	Atlantic division, Porto Bello quarry.		Pacific division, Ancon quarry.	
	1912	1911	1912	1911
Crushed stone produced (cubic yards).....	440,413	864,033	839,279	855,824
Quarrying:				
Stripping.....	\$0.0040	\$0.0174	\$0.0423	\$0.0476
Drilling.....	.0431	.0450	.0552	.0449
Blasting.....	.1622	.1980	.0465	.0421
Loading.....	.0774	.0921	.0356	.0452
Transportation.....	.0669	.0758	.0576	.0727
Tracks.....	.0340	.0464	.0379	.0243
Power.....	.0353	.0289		
Maintenance of equipment.....	.0621	.0981	.0568	.0333
Plant arbitrary.....	.4897	.3350	.1903	.2447
Total.....	.9747	.9367	.5222	.5548
Crushing:				
Operation crushers.....	.0283	.0355	.0179	.0172
Stone bins and conveyors.....	.0168	.0311	.0045	.0045
Power.....	.0462	.0394	.0187	.0183
Maintenance of equipment.....	.0827	.1158	.0311	.0175
Plant arbitrary.....	.2524	.1726	.0592	.0762
Total.....	.4264	.3944	.1314	.1337
Division expense.....	.0269	.0551	.0184	.0228
Total cost of production.....	1.4280	1.3862	.6720	.7113

Items.	Atlantic division, Porto Bello quarry.		Pacific division, Ancon quarry.	
	1912	1911	1912	1911
Towing:				
Operation tugs and barges.....	\$0.1557	\$0.1592	.....	.....
Maintenance of equipment.....	.1267	.1063	.....	.....
Plant arbitrary.....	.1794	.1975	.....	.....
Total.....	.4618	.4630	.....	.....
Unloading:				
Operation cableways and cranes.....	.0987	.1168	.....	.....
Power.....	.0608	.0195	.....	.....
Maintenance of equipment.....	.0224	.0929	.....	.....
Plant arbitrary.....	.3441	.2050	.....	.....
Total.....	.5260	.4342	.....	.....
Rail transportation to storage:				
Cubic yards transported.....	139,167	275,148	839,279	855,824
Operation of trains.....	\$0.1297	\$0.0819	\$0.0366	\$0.0447
Repairs to tracks.....	.0194	.0142	.0004	.0075
Dumping in storage.....	.....	.0155	.0110	.0098
Maintenance of equipment.....	.1022	.0672	.0206	.0157
Plant arbitrary.....	.....	.....	.0590	.0553
Total.....	.2513	.1788	.1276	.1330
Total cost in storage.....	2.4952	2.3403	.7996	.8443

The operation of the Porto Bello crusher was discontinued on April 30, 1912, so that the average production per month during the period operated was 44,041 cubic yards, while last year during the period March to June, when similar conditions prevailed—that is, an eight-hour day and the large crusher in service—the average per month was 68,760 cubic yards. Notwithstanding this decrease, the cost of production during the year, compared with the period March to June of last year, increased \$0.2014 per cubic yard; and, as the arbitraries for plant increased \$0.2345 per cubic yard, due to decreased estimate of quantities, the actual production cost decreased \$0.0331 per cubic yard.

For the fiscal year 1912 the cost of stone in storage (\$2.4952 per cubic yard) compared with that produced at the Ancon quarry (\$0.7996 per cubic yard) is greater by \$1.6956 per cubic yard. If there be deducted from this difference the extra expense attached to Porto Bello stone, represented by the difference between the cost of towing and unloading, and that of transporting by rail (\$0.7365 per cubic yard), and the difference in plant arbitraries (\$0.4336 per cubic yard), the net difference in work cost in favor of the Ancon quarry is \$0.5255 per cubic yard.

With approximately the same output in both years, the cost in storage of crushed rock from Ancon quarry is less by \$0.0447 per cubic yard than it was last year. This is partly due to lower arbitraries for plant, owing to increased estimates of quantities \$0.0677, and to decreased cost of transportation to storage \$0.0140, offset by increase in repairs to equipment of \$0.0420 per cubic yard.

The Ancon quarry was operated 9 hours per day from July 1, 1911, to February 29, 1912, and from April 1 to 16 and June 1 to 30, 1912, and 18 hours per day from March 1 to 31 and April 17 to May 31, 1912. Eliminating the month of April, during which the quarry was operated partly 9 hours and partly 18 hours, the quantities produced and average costs for the 9-hour and 18-hour day was:

	Nine-hour period, July to February and June.	Eighteen- hour period, March and May.
Quantities.....cubic yards..	554,684	201,825
Average per month.....do.....	61,972	100,912
Quarrying.....	\$0.5316	\$0.4784
Crushing.....	.1419	.1171
Transportation.....	.1347	.1108
Division expense.....	.0190	.0157
Total.....	.8272	.7220

TABLE NO. 10.—SAND PRODUCTION.

The quantities and average detail cost per cubic yard of sand secured by the Atlantic division at Nombre de Dios and by the Pacific division at Chame for the fiscal years 1912 and 1911, were:

Items.	Atlantic division, Nombre de Dios.		Pacific division, Chame.	
	1912	1911	1912	1911
Quantity of sand secured:				
By excavation.....cubic yards.....		29,539		
Cost.....		\$0.7975		
By dredging.....cubic yards.....	144,123	412,380	564,837	494,841
Operation of dredges.....	\$0.1913	\$0.2444	\$0.0905	\$0.0926
Maintenance and equipment.....	.1309	.1010	.0403	.0354
Total.....	.3222	.3454	.1308	.1280
Total production.....cubic yards.....	144,123	441,919	564,837	494,841
Operating cost.....	\$0.3222	\$0.3756	\$0.1308	\$0.1280
Plant arbitrary.....	.7890	.4740	.0202	.0300
Division expense.....	.0096	.0299	.0137	.0208
Total cost of production.....	1.1208	.8795	.1647	.1788
Towing:				
Operation of tugs and barges.....	.2235	.2084	.0936	.1067
Maintenance of equipment.....	.1311	.1130	.0493	.0553
Plant arbitrary.....	.2820	.2209	.0309	.0649
Total.....	.6366	.5423	.1738	.2209
Unloading:				
Operation of cableways and cranes.....	.1027	.1189	.0646	.0532
Power.....	.0189	.0188	.0196	.0284
Maintenance of equipment.....	.0712	.0782	.0335	.0599
Plant arbitrary.....	.2170	.1496	.0545	.1067
Total.....	.4098	.3655	.1722	.2482
Rail transportation to storage:				
Cubic yards transported.....	60,494	157,967	564,837	475,422
Operation of trains.....	\$0.0993	\$0.0982	\$0.0403	\$0.0462
Repairs to tracks.....	.0096	.0163	.0369	.0197
Dumping in storage.....		.0002	.0120	.0134
Maintenance of equipment.....	.0677	.0787	.0241	.0174
Plant arbitrary.....			.0785	.0849
Total.....	.1766	.1934	.1918	.1816
Total cost in storage.....	2.2414	1.8565	.7025	.8284

Operations at Nombre de Dios were discontinued on November 17, 1911, so that the average monthly production this year was 32,027 cubic yards, as compared with 36,827 cubic yards last year. The cost per cubic yard delivered in storage increased \$0.3849 per cubic yard, due to increase in plant arbitrary of \$0.4435 per cubic yard, owing to overestimation of quantities of sand required, partially offset by decrease of \$0.0534 in cost of production, due to high cost of securing sand by excavation last year.

Sand was procured at Chame throughout the year in increased quantities. There is a decrease in cost delivered in storage of \$0.1259 per cubic yard, \$0.1024 being due to decreased arbitraries owing to increased estimate of quantities required, and to decreased cost of water transportation, due to increased output.

There is an excess this year of \$1.5389 per cubic yard in the cost of sand in storage from Nombre de Dios compared with that from Chame. The difference in "Plant arbitrary" is \$1.1039 per cubic yard, leaving a difference in operating cost of \$0.4350 per cubic yard, as follows: Production \$0.1873, towing \$0.2117, and unloading \$0.0751; offset by excess cost of transportation by rail of Chame sand (if 83,629 cubic yards produced at Nombre de Dios, but not transported by rail, be considered) of \$0.0391 per cubic yard. The operating cost for rail transportation, based on the actual number of cubic yards transported, shows excess in favor of Chame of \$0.0633.

From May 15 to June 30, 1912, the Atlantic division secured from one of the dredges pumping hydraulic fill in Gatun Dam 40,531 cubic yards of sand, at an average cost of \$1.2850 per cubic yard. Detailed cost appears in Table No. 10.

TABLES NOS. 7 AND 11.—PILING FOR FOUNDATIONS.

The quantities and cost per linear foot of concrete piles manufactured for use in the foundations of the south approach wall of Gatun Locks for the fiscal years 1912 and 1911 were:

Items.	1912	1911
Quantities.....linear feet..	73,695	31,060
Cement.....	\$0.0837	\$0.0930
Stone.....	.0645	.0846
Sand.....	.0088	.0172
Mixing.....	.0482	.0549
Placing.....	.0438	.0392
Reenforcements.....	.7152	.7000
Forms.....	.0547	.1030
Maintenance of equipment.....	.0026	.0058
Plant arbitrary.....	.1810	.1700
Division expenses.....	.0131	.0158
Total cost.....	1.2156	1.2835

The manufacture of concrete piles ceased in November, 1911, up to which time 104,755 linear feet had been produced, at an average cost of \$1.2358.

The quantity and average division cost per linear foot of concrete piles driven in place for foundations of south approach wall of Gatun Locks during the fiscal years 1912 and 1911 were:

	1912	1911
Quantities.....linear feet..	75,474	8,196
Piling in place.....	\$1.4849	\$2.1234
Maintenance of equipment.....	.0078	.0679
Division expense.....	.0105	.0207
Total division cost.....	1.5032	2.2120

This work was completed in March, 1912, when a total of 83,670 linear feet had been driven at an average division cost of \$1.5719 per linear foot.

In addition to the concrete piling, there were driven for the foundations of the south approach wall, during the fiscal year 1912, 51,450 linear feet of wooden piles, at an average division cost of \$0.6516 per linear foot.

In the Pacific division 6,580 linear feet of wooden piles were driven for the foundations of the northeast wing wall of locks at Miraflores, at an average division cost of \$7.6390 per linear foot. This high cost is apparent only as on June 30 there were 57,375 linear feet of piling which had been charged to the work, but had not been driven. Deducting the value of this piling from the total charge, the cost for piling in place was \$2.32 per linear foot.

TABLE NO. 12.—POWER PLANTS.

The power plant at Gatun generated this year 16,263,510 kilowatt hours, at an average division cost of \$0.022 per kilowatt hour, as against 12,962,247 kilowatt hours and a cost of \$0.0227 last year. The power plant at Miraflores generated this year 9,522,400 kilowatt hours at an average division cost of \$0.0229 per kilowatt hour, as against 6,797,714 kilowatt hours and a cost of \$0.0274 per kilowatt hour last year. Included in the average cost are arbitraries sufficient to absorb the total cost of these plants during the construction of the canal. During the fiscal year 1912, these arbitraries were \$0.0103 and \$0.01 per kilowatt hour for Gatun and Miraflores plants, respectively. The above figures represent the generating cost only, and do not include expenses of pile lines, or other installation outside of the power houses.

TABLE NO. 13.—LIGHTING AND BUOYING CANAL.

During the fiscal year, 809.85 acres were cleared, at an average division cost of \$22.7098 per acre. The masonry construction in the following pairs of range lights was completed, and the quantities of concrete laid and the average division costs were:

Items.	Pacific division, No. 9-11.		Pacific division, No. 13-14.		Atlantic division, No. 5-6.		Lake, No. 24-25.	
	Quan- tities.	Unit cost.	Quan- tities.	Unit cost.	Quan- tities.	Unit cost.	Quan- tities.	Unit cost.
Foundations.....	<i>Cu. yds.</i> 194.00	\$31.3093	<i>Cu. yds.</i> 99.20	\$30.2182	<i>Cu. yds.</i> 38.90	\$18.8069	<i>Cu. yds.</i> 19.90	\$16.2317
Structures.....	62.57	50.1529	79.52	21.5451	96.42	31.2318	62.57	28.3489
Handling material.....	256.57	2.6681	178.52	12.1365	135.32	7.6423	82.47	15.4523
Division expense.....	256.57	4.7024	178.52	5.3734	135.32	5.4120	82.47	7.0136
Total division cost.....	256.57	43.2752	178.52	44.7723	135.32	43.8179	82.47	51.2641

One tower each of ranges 1-2 and 21-22, in the lake region, were completed; the quantities of concrete and average division costs per cubic yard were:

Items.	Lake, No. 1.		Lake, No. 21.	
	Quantities.	Unit cost.	Quantities.	Unit cost.
	<i>Cubic yards.</i>		<i>Cubic yards.</i>	
Foundations.....	87.30	\$28.8518	10.48	\$14.4695
Structures.....	22.05	41.0594	10.92	54.4908
Handling material.....	109.35	4.6037	21.40	24.6061
Division expense.....	109.35	4.6020	21.40	9.6308
Total division cost.....	109.35	45.3509	21.40	70.8850

Tower No. 2, of range 1-2, Pacific division, was also completed during the year, but, as the accounts include charges pertaining to foundations of tower No. 1 of this range, the total cost is not shown in the above table. In the structure of this tower, 22.05 cubic yards of concrete were used, at an average division cost of \$25.9896 per cubic yard.

The high cost of the item "Handling material" is due to the inaccessibility of the locations on which these structures are being erected, necessitating the carrying of all material by hand, in some instances even the water for mixing the concrete having been carried in buckets. The cost at tower No. 21, Lake, is further increased by numerous breakdowns of launch used in carrying material, etc.

The high cost per cubic yard under "Structures" is partially due to expense of adjusting the steel forms when used for the first time. The average cost for the remaining towers should, therefore, show a substantial decrease as compared with these figures.

Table No. 13 shows in detail other items of expenditures for buoying and lighting the canal, no comments thereon being necessary.

TABLE NO. 14.—HYDRAULIC FILLING IN CITY OF COLON.

During the fiscal year 1912, 129,939 cubic yards of material, borrow-pit measurement, were deposited in this fill, at an average division cost of \$0.3533 per cubic yard, exclusive of charge for plant; as against 698,644 cubic yards last year at an average division cost of \$0.2108 per cubic yard, a total for the project of 828,583 cubic yards, borrow-pit measurement, at a division cost, exclusive of charge for plant, of \$0.2119 per cubic yard. Owing to waste and consolidation, the fill actually in place amounts to 585,527 cubic yards, a loss of 243,056 cubic yards, or 29.33 per cent, making an average division cost, exclusive of charge for plant, for fill in place of \$0.2999 per cubic yard. The dredge placing this fill ceased operation in August, 1911.

TABLE NO. 15.—INSTALLATION LOCKS AND SPILLWAYS OPERATING MACHINERY.

No cost data is as yet available for the installation of machines, as none were completely installed on June 30. During the fiscal year 1912, 6,162 lineal feet of rack tracks for towing locomotives were installed at Gatun Locks, at an average division cost of \$2.0456 per lineal foot, and 4,438 lineal feet at Pedro Miguel Locks, at an average division cost of \$1.3158 per lineal foot, exclusive of the contract cost of the material.

In preparing foundations for the various operating machines, 2,052.9 cubic yards of concrete were used at Gatun Locks, at an average division cost of \$13.3319 per cubic yard; and 296 cubic yards at Pedro Miguel Locks, at an average division cost of \$34.7781 per cubic yard. Included in the latter cost is the initial expense for the forms, which will be used throughout the period of installation, and amounts to \$22.8818 per cubic yard on the quantity laid to June 30, 1912.

EXHIBIT C.—PERFORMANCE SHEETS.

TABLES NOS. 1 AND 7.—ROCK CRUSHERS.

A comparison of the performance of the rock-crushing plants for the fiscal years 1912 and 1911 is given in the following table:

	Porto Bello.		Ancon.	
	1912	1911	1912	1911
Hours in service.....	¹ 2,024.00	3,412.00	3,315.00	3,039.00
Hours at work.....	1,008.83	2,279.24	2,383.78	2,254.96
Number cubic yards of stone produced.....	440,413.00	864,033.00	837,908.00	855,824.00
Average number cubic yards per hour in service.....	217.60	253.23	252.76	281.61
Average number cubic yards per hour at work.....	436.56	348.51	351.50	379.53
Per cent of working time to hours in service.....	49.84	72.66	71.91	74.20

¹ To Apr. 30, 1912.

TABLES NOS. 2, 3, AND 8.—UNLOADING PLANTS.

The cableways and derricks in the Atlantic division unload sand and stone from barges. The electric cranes in the Pacific division handle only sand. A comparative statement of the work done by each plant during the fiscal years 1912 and 1911 follows:

	Atlantic division.				Pacific division, electric cranes.	
	Cableway strands.		Derricks.			
	1912	1911	1912	1911	1912	1911
Average number operated.....	4.39	5.00	1 3.83	3.93	2.00	2.00
Total unit hours in service....	11,398.10	35,117.00	7,545.55	22,969.00	4,872.00	4,857.43
Total unit hours at work.....	6,575.41	17,359.76	3,868.70	11,274.75	3,499.50	3,428.86
Cubic yards material handled.	346,767.00	742,408.00	192,916.00	461,271.00	564,837.00	494,841.00
Average number of cubic yards material handled per hour in service.....	30.42	21.14	25.57	20.08	115.94	101.87
Average number of cubic yards material handled per hour at work.....	52.74	42.77	49.87	40.91	161.41	144.32
Per cent of working time to hours in service.....	57.69	49.43	51.27	49.08	71.83	70.59

¹ To May 10, 1912.

The percentage of time at work to hours in service shows an increase for all plants over last year. In the Atlantic division it is wholly due to reduction of working time from 24 and 16 hours, with three and two shifts, to 8 hours per day with one shift. In the Pacific division the increase is due to increased quantity handled during the same service time.

TABLES NOS. 4 AND 5.—MIXING PLANTS.

A comparison of the work done by the mixing plants in the Atlantic and Pacific divisions during the fiscal years 1912 and 1911, follows:

ATLANTIC DIVISION.—TABLES NOS. 4 AND 5.

	Construction plant.		Auxiliary plant.	
	1912	1911	1912	1911
Average number mixers in use.....	4.30	6.08	¹ 1.89	2.00
Total hours in service.....	13,453.06	22,694.68	3,628.48	5,573.50
Total hours at work.....	5,794.30	13,330.25	1,175.19	3,312.57
Cubic yards concrete mixed.....	343,364.00	602,851.00	80,544.00	226,476.00
Average number cubic yards of concrete mixed per hour in service.....	25.52	26.56	22.20	40.63
Average number cubic yards of concrete mixed per hour at work.....	59.26	45.22	68.54	68.37
Per cent of working time to hours in service.....	43.07	58.74	32.39	59.43

¹ To Mar. 12, 1912, when plant was dismantled.

PACIFIC DIVISION.—TABLES NOS. 9, 11, AND 12.

	Pedro Miguel Locks.		Miraflones Locks.		
	Auxiliary plant, 1912.	Berm cranes, 1911.	Berm cranes.		Auxiliary mixers, 1912.
			1912	1911	
Average number mixers in use.....	2.14	3.08	6.55	3.59	2.09
Total hours in service.....	5,844.50	7,570.03	19,287.99	2,655.00	6,291.00
Total hours at work.....	3,391.67	5,394.19	10,763.85	1,652.79	3,820.85
Cubic yards concrete mixed.....	122,497.00	379,190.00	409,651.00	67,774.00	253,450.00
Average number of cubic yards concrete mixed per hour in service.....	20.96	50.09	21.24	25.53	40.29
Average number of cubic yards concrete mixed per hour at work.....	36.12	70.30	38.06	41.69	66.33
Per cent of working time to hours in service.....	58.03	71.26	55.80	62.25	60.74

At Miraflones the berm cranes not only handle the concrete material to the mixers installed on them, as they did at Pedro Miguel, but also place the mixed concrete in the forms, and handle the lock walls such material as forms, steel, etc., which accounts for the reduction in quantity mixed per hour.

TABLES NOS. 6, 10, 11, AND 13.—PLACING PLANTS.

A comparative statement of work done by the placing plants in the Atlantic and Pacific divisions during the years 1912 and 1911, follows:

	Atlantic division, cable-way strands.		Pacific division.			
			Pedro Miguel, chamber cranes.		Miraflones.	
					Chamber cranes.	Berm cranes.
	1912	1911	1912	1911	1912	1912
Average number operated.....	8.00	8.00	¹ 1.72	3.45	2.48 ¹	3.58
Total number hours in service.....	25,404.60	29,616.98	2,943.74	9,238.12	7,486.96	10,502.00
Total number hours handling concrete and large rock.....	9,840.53	19,003.03	669.68	6,230.02	4,143.23	5,827.31
Total number hours handling steel, forms, etc.....	4,514.33	2,606.96	1,148.28	.....	674.17	683.86
Cubic yards concrete and other material handled.....	309,534.00	616,661.00	28,450.00	401,725.00	241,862.00	409,651.00
Average number of cubic yards of concrete and large rock handled per hour in that work.....	31.46	32.45	42.48	64.71	58.38	70.30
Per cent of working time to hours in service.....	56.51	72.96	61.76	67.44	64.34	62.00

¹ To Jan. 29, 1912, when dismantling of last crane commenced.

EXHIBIT D—COMPARATIVE STATEMENT OF ADMINISTRATIVE AND GENERAL EXPENSES.

Administrative and general expenses amounted to:

During fiscal year 1912.....	\$2,373,433.06
During fiscal year 1911.....	2,537,405.89

A decrease of..... 163,972.83

Included in both years were the expenses for the inspection of lock gates, locks operating machinery, emergency dams, and spillway gates and machinery, which amounted to \$146,275.38 in 1912 and \$43,249.96 in 1911. These expenses are located to certain units of construction and are not "general expenses" in the meaning of that term, so it is intended to transfer them to direct division cost in the accounts for the year 1913. In the year 1911 hotel equipment, \$21,330.53, and hotel incidental expenses, \$22,559.18, were included in "general expenses," but are carried as "general items" in 1912, to be offset by the profits of the operations of hotels and messes. If these items be eliminated, the administrative and general expenses were—

For 1912.....	\$2,227,157.68
For 1911.....	2,450,266.22

a decrease of \$223,108.54, or 9.01 per cent, compared with 1911. This decrease appears under the following heads: General administrative expenses, \$34,890.21, due to reduction of force and consolidation of third division, chief engineer's office, with second division, chief engineer's office; examiner of accounts and disbursing officer on Isthmus, \$15,025.72, due to reduction of force; passenger transportation on Isthmus, \$13,950.48, due to decrease of \$8,000 in payments to Panama Railroad for this service and to collection from Canal Zone Government for transportation by rail of children to and from school;

telegraph and telephones, \$7,437.63, due to decrease in monthly payment to Panama Railroad Co. for telephone service; operation of stores, \$34,280.93, due to collection from Panama Railroad Co. for its proportion of this service, the consolidation of the commission's and Panama Railroad's storehouses having resulted in no extra expense to the quartermaster's department, and to reduction of force at Empire and Gatun storehouses; recruiting and repatriating, \$5,453.43, due to fewer laborers and other employees brought to the Isthmus; quarters, \$64,859.20, due to abandonment of settlements at Tabernilla and San Pablo in January, 1912, to continued reduction of janitor and supervisory forces, and in issue of new furniture; construction of buildings, department of construction and engineering, \$5,644.98—there were no large buildings constructed this year; operations docks and wharves, Isthmian Canal Commission, \$62,867.83. This account represents the cost of operating the wharves at Mount Hope, used principally to unload material for the commission, and the decrease is due to the decreased receipts at that point of lumber and other material.

The items of increase are: "General expenses on Isthmus," \$6,049.68, due to construction of one motor car and alterations to another, and "General expenses in the United States," \$8,358.55, principally due to expenses of Commissioner Emory R. Johnson, and to heavy expenses for telegraph and cable.

EXHIBIT E.—SALARY DISBURSEMENTS BY DEPARTMENTS AND DIVISIONS.

The Congress appropriates separately for "Pay of officers and employees" and for "Skilled and unskilled labor." Disbursements from these appropriations by the department of construction and engineering for the year 1912 totaled \$17,673,385.61, against \$17,821,150.89 last year. During 1912, 20.55 per cent of the amount disbursed was from appropriations for "Officers and employees," and 79.45 per cent from appropriations for "Skilled and unskilled labor," the proportions for 1911 having been 21.32 per cent and 78.68 per cent, respectively.

From the appropriation "Pay of officers and employees" are paid the salaries of the clerical and supervisory forces, so that the disbursements, therefore, are in the nature of a surcharge to the productive salary expenditures, represented by the disbursements from the appropriation for "Skilled and unskilled labor." In 1912 the disbursements from appropriation "Officers and employees" equaled a surcharge of 25.86 per cent on the disbursements from appropriation "Skilled and unskilled labor"; in 1911 of 27.09 per cent—thus indicating a saving in supervisory and clerical forces of \$172,720.92, as compared with last year.

The ratio of disbursements by the construction divisions from the appropriation "Officers and employees" to their total disbursements during the fiscal years 1912 and 1911 was:

	1912	1911
	<i>Per cent.</i>	<i>Per cent.</i>
Atlantic division.....	20.69	20.67
Central division.....	14.81	15.11
Pacific division.....	15.92	18.67

The disbursements for supervisory and clerical forces in the three construction divisions amounted to a surcharge on productive labor in 1912 and 1911 of:

	1912	1911
	<i>Per cent.</i>	<i>Per cent.</i>
Atlantic division.....	26.09	26.05
Central division.....	17.39	17.80
Pacific division.....	18.94	22.95

so that, had the percentage of payment for supervisory force been the same in the Pacific as in the Atlantic division, its total salary disbursements would have been increased by \$228,000, and had the percentage of payment for supervisory forces been the same in the Atlantic as in the Pacific division its total salary disbursements would have been decreased by \$246,000.

EXHIBIT F.—CONSTRUCTION OF PANAMA RAILROAD CO. DOCK AT BALBOA.

This statement shows the total cost of this project, which is completed, except for the dredging in front of the dock. To June 30, 1912, 1,005,983 cubic yards had been dredged, at an average cost of \$0.1309. In constructing the foundations 22,666 cubic yards of material were excavated, at an average cost of \$3.1071 per cubic yard; 2,672.42 lineal feet of concrete caisson were sunk, the cost in place, excluding excavation, being \$33.9578 per lineal foot, and including excavation, \$60.3106; 6,341 cubic yards of concrete were used in making and filling these caissons, at an average cost of \$14.3116 per cubic yard; 38,830 square feet of concrete flooring were laid, at an average cost of \$1.0961 per square foot, for which 2,353 cubic yards of concrete, costing an average of \$18.0883 per cubic yard, were used. Exclusive of the cost of dredging the total cost of this dock was \$5.6671 per square foot of dock space.

Appended hereto are the exhibits referred to in this report.

Respectfully submitted.

AD. FAURE,
Cost-Keeping Accountant.

Col. GEORGE W. GOETHALS, *United States Army,*
Chairman and Chief Engineer,
Isthmian Canal Commission, Culebra, Canal Zone.

EXHIBITS SUBMITTED WITH REPORT OF COST-KEEPING ACCOUNTANT.

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EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912.

TABLE 1.—Statement of construction expenditures to June 30, 1912.

ATLANTIC DIVISION.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dry excavation—Prism:							
May 4, 1904, to June 30, 1909.....	<i>Cubic yds.</i> 1,152,105	\$673,330.97	\$0.5844	\$102,017.26	\$0.0886	\$775,348.23	\$0.6730
Fiscal year 1910.....	324,716	201,916.36	.6218	24,985.55	.0770	226,901.91	.6988
Fiscal year 1911.....	280,305	168,440.60	.6010	13,946.79	.0497	182,387.39	.6507
Fiscal year 1912.....	424,872	252,886.45	.5952	17,265.97	.0406	270,152.42	.6358
Total to June 30, 1912.....	2,181,998	1,296,574.38	.5942	158,215.57	.0725	1,454,789.95	.6667

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1912—Continued.

ATLANTIC DIVISION—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Hydraulic excavation—Prism:							
Fiscal year 1911.....	<i>Cubic yds.</i> 28,605	\$7,721.28	\$0.2699	\$1,143.49	\$0.0400	\$8,864.77	\$0.3099
Fiscal year 1912.....	1,000	2,597.59	2.5976	208.96	.2090	2,806.55	2.8066
Total to June 30, 1912.....	29,605	10,318.87	.3485	1,352.45	.0457	11,671.32	.3942
Dredging excavation—Prism:							
May 4, 1904, to June 30, 1909.....	13,188,123	2,654,951.70	.2013	273,425.93	.0207	2,928,377.63	.2220
Fiscal year 1910.....	4,955,660	1,169,667.60	.2360	131,370.17	.0265	1,301,037.77	.2625
Fiscal year 1911.....	5,828,345	1,291,257.03	.2215	126,902.35	.0218	1,418,159.38	.2433
Fiscal year 1912.....	4,870,827	1,208,226.15	.2481	100,928.48	.0207	1,309,154.63	.2688
Total to June 30, 1912.....	28,842,955	6,324,102.48	.2193	632,626.93	.0219	6,956,729.41	.2412
Plant:							
Amount to be absorbed after June 30, 1912.....		386,121.97				386,121.97	
Total.....		6,710,224.45		632,626.93		7,342,851.38	
GATUN SPILLWAY.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	1,296,332	778,514.20	.6006	127,355.38	.0982	905,869.58	.6988
Fiscal year 1910.....	122,487	117,945.47	.9629	15,460.31	.1262	133,405.78	1.0891
Fiscal year 1911.....	125,383	51,014.89	.4069	5,890.34	.0470	56,905.23	.4539
Total to June 30, 1912.....	1,544,202	947,474.56	.6136	148,706.03	.0963	1,096,180.59	.709
Preparing foundations:							
Fiscal year 1910.....	4,723	18,632.78	3.9451	2,732.07	.5785	21,364.85	4.5236
Fiscal year 1911.....	32,245	48,521.10	1.5048	5,893.94	.1828	54,415.04	1.6876
Fiscal year 1912.....	7,123	18,804.83	2.6400	1,882.79	.2643	20,687.62	2.9043
Total to June 30, 1912.....	44,091	85,958.71	1.9496	10,508.80	.2383	96,467.51	2.1879
Masonry:							
Concrete, plain—							
May 4, 1904, to June 30, 1909....	30,464	223,203.73	7.3268	20,565.26	.6751	243,768.99	8.0019
Fiscal year 1910..	53,632	461,338.27	8.6019	27,380.14	.5105	488,718.41	9.1124
Fiscal year 1911..	59,651	399,925.98	6.7044	16,875.75	.2829	416,801.73	6.9873
Fiscal year 1912..	58,048	407,108.10	7.0133	23,825.85	.4105	430,933.95	7.4238
Total to June 30, 1912.....	201,795	1,491,576.08	7.3915	88,647.00	.4393	1,580,223.08	7.8308
Concrete, reinforced—							
Fiscal year 1912 (total).....	618	9,370.80	15.1631	704.30	1.1396	10,075.10	16.3027
Total masonry.	202,413	1,500,946.88	7.4153	89,351.30	.4414	1,590,298.18	7.8567
Ironwork:							
Fiscal year 1910.....		346.26		41.60		387.86	
Fiscal year 1911.....		16,869.54		2,573.79		19,443.33	
Fiscal year 1912.....		80,153.39		14,133.29		94,286.68	
Total to June 30, 1912.....		97,369.19		16,748.68		114,117.87	
Gates, fiscal year 1912 (total).....		29,981.71				29,981.71	

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1912—Continued.

ATLANTIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN SPILLWAY—CON.							
Backfilling:	<i>Cubic yds.</i>						
Fiscal year 1910.....	1,781	\$1,005.69	\$0.5647	\$93.55	\$0.0525	\$1,099.24	\$0.6172
Fiscal year 1911.....	12,873	6,220.54	.4832	773.45	.0601	6,993.99	.5433
Fiscal year 1912.....	10,062	3,921.88	.3898	441.07	.0438	4,362.95	.4336
Total to June 30, 1912.....	24,716	11,148.11	.4510	1,308.07	.0529	12,456.18	.5039
Total Gatun Spillway....		2,672,879.16		266,622.88		2,939,502.04	
GATUN DAM.							
Dredging excavation:							
May 4, 1904, to June 30, 1909.....	38,425	18,322.71	.4769	1,718.48	.0447	20,041.19	.5216
Dry filling:							
May 4, 1904, to June 30, 1909.....	2,244,622	927,319.57	.4131	181,339.46	.0808	1,108,659.03	.4939
Fiscal year 1910.....	2,555,197	757,828.15	.2966	87,078.24	.0340	844,906.39	.3306
Fiscal year 1911.....	2,653,908	1,011,978.51	.3813	75,967.00	.0286	1,087,945.51	.4099
Fiscal year 1912.....	2,608,073	1,349,360.15	.5174	93,511.62	.0359	1,442,871.77	.5533
Total to June 30, 1912.....	10,061,800	4,046,486.38	.4022	437,896.32	.0435	4,484,382.70	.4457
Hydraulic filling:							
May 4, 1904, to June 30, 1909.....	720,047	162,553.19	.2258	34,540.85	.0479	197,094.04	.2737
Fiscal year 1910.....	2,933,175	786,641.96	.2682	59,910.57	.0204	846,552.53	.2886
Fiscal year 1911.....	4,256,393	974,230.44	.2289	77,572.23	.0182	1,051,802.67	.2471
Fiscal year 1912.....	2,604,632	1,001,405.34	.3844	52,407.82	.0201	1,053,813.16	.4045
Total to June 30, 1912.....	10,514,247	2,924,830.93	.2782	224,431.47	.0213	3,149,262.40	.2995
Paving:							
Fiscal year 1910.....	22,037	6,372.92	.2892	415.58	.0189	6,788.50	.3081
Fiscal year 1911.....	18,374	7,111.63	.3871	819.56	.0446	7,931.19	.4317
Total to June 30, 1912.....	40,411	13,484.55	.3337	1,235.14	.0305	14,719.69	.3642
Total Gatun Dam.....		7,003,124.57		665,281.41		7,668,405.98	
Total Gatun Dam and Spillway.....		9,676,003.73		931,904.29		10,607,908.02	
Plant—Overcharge to be adjusted in year of 1913.....		¹ 115,540.84				¹ 115,540.84	
Total.....		9,560,462.89		931,904.29		10,492,367.18	
GATUN LOCKS.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	3,240,218	1,729,279.35	.5337	217,726.78	.0672	1,947,006.13	.6009
Fiscal year 1910.....	839,302	687,602.40	.8193	73,991.47	.0881	761,593.87	.9074
Fiscal year 1911.....	475,875	338,332.43	.7110	37,019.15	.0778	375,351.58	.7888
Fiscal year 1912.....		¹ 3,337.87				¹ 3,337.87	
Total to June 30, 1912.....	4,555,395	2,751,876.31	.6041	328,737.40	.0722	3,080,613.71	.6763
Dredging excavation:							
May 4, 1904, to June 30, 1909.....	488,533	79,978.65	.1637	9,427.51	.0193	89,406.16	.1830
Fiscal year 1911.....		2,999.32		305.94		3,305.26	
Fiscal year 1912.....	883,918	276,568.07	.3129	11,576.12	.0131	288,144.19	.3260
Total to June 30, 1912.....	1,372,451	359,546.04	.2620	21,309.57	.0155	380,855.61	.2775

¹ Denotes credit.

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1912—Continued.

ATLANTIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN LOCKS—contd.							
Preparing foundations:							
Excavation—	<i>Cubic yds.</i>						
Fiscal year 1910..	33,843	\$85,109.77	\$2.5148	\$13,392.73	\$0.3957	\$98,502.50	\$2.9105
Fiscal year 1911..	152,582	237,098.48	1.5540	27,640.92	.1811	264,739.40	1.7351
Fiscal year 1912..	8,888	26,307.20	2.9598	2,207.51	.2484	28,514.71	3.2082
Total to June 30, 1912.....	195,313	348,515.45	1.7844	43,241.16	.2214	391,756.61	2.0058
Filling—							
Fiscal year 1910..	17,883	10,607.43	.5932	.....	.....	10,607.43	.5932
Fiscal year 1911..	22,234	4,239.79	.1907	379.51	.0171	4,619.30	.2078
Total to June 30, 1912.....	40,117	14,847.22	.3701	379.51	.0095	15,226.73	.3796
Concrete piling under south ap- proach wall (linear feet)—							
Fiscal year 1911..	8,196	18,129.46	2.2120	635.29	.0775	18,764.75	2.2895
Fiscal year 1912..	75,474	113,389.34	1.5032	2,418.27	.0320	115,807.61	1.5352
Total to June 30, 1912.....	83,670	131,518.80	1.5719	3,053.56	.0365	134,572.36	1.6084
Wooden piling under under south ap- proach wall (linear feet)—							
Total, fiscal year 1912.....	51,450	33,525.15	.6516	4,345.26	.0845	37,870.41	.7361
Masonry:							
Concrete, plain—							
May 4, 1904, to June 30, 1909.....	.....	15,093.59	.....	2,054.67	.....	17,148.26	.....
Fiscal year 1910..	513,803	3,779,163.81	7.3553	204,596.95	.3982	3,983,760.76	7.7535
Fiscal year 1911..	902,926	5,952,003.08	6.5919	199,380.61	.2208	6,151,383.69	6.8127
Fiscal year 1912..	390,611	2,785,709.13	7.1317	103,230.79	.2643	2,888,939.92	7.3960
Total to June 30, 1912.....	1,807,340	12,531,969.61	6.9339	509,263.02	.2818	13,041,232.63	7.2157
Concrete, reinforced—							
Fiscal year 1911..	8,211	102,216.13	12.4487	9,261.28	1.1279	111,477.41	13.5766
Fiscal year 1912..	59,883	707,983.96	11.8228	50,105.37	.8367	758,089.33	12.6595
Total to June 30, 1912.....	68,094	810,200.09	11.8983	59,366.65	.8718	869,566.74	12.7701
Total masonry.	1,875,434	13,342,169.70	7.1142	568,629.67	.3032	13,910,799.37	7.4174
Ironwork:							
Fiscal year 1910.....	.....	226,554.37	.....	26,112.31	.....	252,666.68	.....
Fiscal year 1911.....	.....	593,807.35	.....	87,802.13	.....	681,609.48	.....
Fiscal year 1912.....	.....	337,786.43	.....	42,566.42	.....	380,352.85	.....
Total to June 30, 1912.....	.....	1,158,148.15	.....	156,480.86	.....	1,314,629.01	.....
Gates:							
Fiscal year 1911.....	.....	40,586.48	.....	5,999.82	.....	46,586.30	.....
Fiscal year 1912.....	.....	868,144.22	.....	107,052.85	.....	975,197.07	.....
Total to June 30, 1912.....	.....	908,730.70	.....	113,052.67	.....	1,021,783.37	.....

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1912—Continued.

ATLANTIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
GATUN LOCKS—Contd.							
Back filling:	<i>Cubic yds.</i>						
Fiscal year 1910.....	4,190	\$4,811.52	\$1.1483	\$388.29	\$0.0927	\$5,199.81	\$1.2410
Fiscal year 1911.....	535,669	284,221.51	.5307	29,446.89	.0549	313,668.40	.5856
Fiscal year 1912.....	922,215	425,613.92	.4615	36,766.53	.0399	462,380.45	.5014
Total to June 30, 1912.....	1,462,074	714,646.95	.4888	66,601.71	.0455	781,248.66	.5343
Filling center wall:							
Fiscal year 1911.....	2,717	2,889.16	1.0634	212.09	.0780	3,101.25	1.1414
Fiscal year 1912.....	94,574	71,946.90	.7607	2,809.91	.0297	74,756.81	.7904
Total to June 30, 1912.....	97,291	74,836.06	.7692	3,022.00	.0311	77,858.06	.8003
Filling around south ap- proach wall:							
Total, fiscal year 1912—							
Dry.....	7,072	3,600.90	.5092	176.71	.0250	3,777.61	.5342
Hydraulic.....	594,495	91,847.98	.1545	2,229.51	.0038	94,077.49	.1583
Electrical machinery:							
Total, fiscal year 1912		531,793.93	.....	22,043.38	.....	553,837.31	.....
Total, Gatun locks.....		20,465,603.34	.....	1,333,302.97	.....	21,798,906.31	.....
Plant, amount to be absorbed after June 30, 1912.....		175,870.62	.....	.....	.....	175,870.62	.....
Total.....		20,641,473.96	.....	1,333,302.97	.....	21,974,776.93	.....
GATUN PERMANENT POWER PLANT.							
Total, fiscal year 1912:							
Dry excavation.....	72,119	27,163.41	.3767	1,596.61	.0221	28,760.02	.3988
Machinery.....		8,855.00	.....	.....	.....	8,855.00	.....
Total, Gatun power plant.....		36,018.41	.....	1,596.61	.....	37,615.02	.....
GATUN-MINDI LEVEE.							
Dry filling:							
Fiscal year 1910.....	126,002	51,789.04	.4110	6,125.69	.0486	57,914.73	.4596
Fiscal year 1911.....	51,156	10,128.74	.1979	941.68	.0184	11,070.42	.2163
Total to June 30, 1912.....	177,158	61,917.78	.3495	7,067.37	.0399	68,985.15	.3894
Hydraulic filling:							
Total, fiscal year 1911.	20,378	3,326.91	.1631	156.41	.0077	3,483.32	.1708
Total, Gatun-Mindi levee.....		65,244.69	.....	7,223.78	.....	72,468.47	.....
COLON BREAKWATER.							
Dry filling:							
May 4, 1904, to June 30, 1909.....		7,436.72	.....	.....	.....	7,436.72	.....
Fiscal year 1910.....		43,773.31	.....	4,910.83	.....	48,684.14	.....
Fiscal year 1911.....	359,890	522,084.39	1.4506	87,177.40	.2423	609,261.79	1.6929
Fiscal year 1912.....	525,173	916,821.49	1.7457	81,764.20	.1557	998,585.69	1.9014
Total to June 30, 1912.....	885,063	1,490,115.91	1.6836	173,852.43	.1965	1,663,968.34	1.8801
Plant:							
Amount to be ab- sorbed after June 30, 1912.....		211,370.13	.....	.....	.....	211,370.13	.....
Total, Colon break- water.....		1,701,486.04	.....	173,852.43	.....	1,875,338.47	.....

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 1.—Statement of construction expenditures to June 30, 1912—Continued.

ATLANTIC DIVISION—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
COLON BREAKWATER— continued.							
Manufacturing plants: Amounts to be ab- sorbed in cost of products after June 30, 1912—							
Porto Bello quarry.....	Cubic yds.	\$188,708.53				\$188,708.53	
Sea transporta- tion plant.....		422,059.46				422,059.46	
Total.....		610,767.99				610,767.99	
Total, Atlantic Di- vision.....		40,632,571.68		\$3,240,075.03		43,872,646.71	

TABLE 2.—Statement of construction expenditures to June 30, 1912.

CENTRAL DIVISION.

	Quantities.	Total division ex- penses, including ar- bitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
Dry excavation—Prism:							
May 4, 1904, to June 30, 1909.....	Cubic yards.	\$37,540,874.34	\$0.9160	\$4,615,073.19	\$0.1126	\$42,155,947.53	\$1.0286
Fiscal year 1910.....	40,983,366	11,945,261.93	.6699	1,152,810.58	.0646	13,098,072.51	.7345
Fiscal year 1911.....	17,832,177	10,891,360.70	.5880	847,225.78	.0457	11,738,586.48	.6337
Fiscal year 1912.....	18,522,692	8,705,143.72	.5101	615,611.56	.0361	9,320,755.28	.5462
Total to June 30, 1912.....	17,063,446	69,082,640.69	.7318	7,230,721.11	.0766	76,313,361.80	.8084
Dredging excavation— Prism:							
Total, May 4, 1904, to June 30, 1909.....	94,401,681	8,067.72		1,730.68		9,798.40	
Clearing canal line (acres):							
Fiscal year 1910.....	2,098	134,857.24	64.2789			134,857.24	64.2789
Fiscal year 1911.....	182	3,991.79	21.9329	467.38	2.5680	4,459.17	24.5009
Fiscal year 1912.....		2,029.51		80.83		2,110.34	
Total to June 30, 1912.....	2,280	140,878.54	61.7888	548.21	.2405	141,426.75	62.0293
Masonry:							
Fiscal year 1911.....	1,020	5,639.35	5.5288	585.09	.5736	6,224.44	6.1024
Fiscal year 1912.....	251	2,000.96	7.9719	128.26	.5110	2,129.22	8.4829
Total to June 30, 1912.....	1,271	7,640.31	6.0113	713.35	.5612	8,353.66	6.5725
Masonry facing (square yards):							
Total, fiscal year 1912.	4,250	3,826.97	.9005	252.14	.0593	4,079.11	.9598
Plant:							
Amount to be ab- sorbed after June 30, 1912.....		87,052.84				87,052.84	
Total, Central Di- vision.....		69,330,107.07		7,233,965.49		76,564,072.56	

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1912.

PACIFIC DIVISION.

	Quantities.	Total division ex- penses, including arbitrarities for plant.		Administrative and general expenses.		Total cost.	
		Amount	Unit cost.	Amount	Unit cost.	Amount.	Unit cost.
Dry excavation:							
Prism—							
May 4, 1904, to	<i>Cubic yds.</i>						
June 30, 1909...	139,470	\$119,747.16	\$0.8586	\$21,514.28	\$0.1542	\$141,261.44	\$1.0128
Fiscal year 1910...	99,703	63,266.48	.6345	6,622.63	.0664	69,889.11	.7009
Fiscal year 1911...	198,770	138,349.00	.6960	12,662.38	.0637	151,011.38	.7597
Fiscal year 1912...	864,475	650,658.11	.7527	37,383.22	.0432	688,041.33	.7959
Total to June 30, 1912.....	1,302,418	972,020.75	.7463	78,182.51	.0600	1,050,203.26	.8063
Plant—							
Amount to be absorbed after June 30, 1912....		247,923.63				247,923.63	
Total.....		1,219,944.38		78,182.51		1,298,126.89	
Hydraulic excavation:							
Prism—							
Fiscal year 1911...	197,677	120,714.14	.6106	9,088.12	.0460	129,802.26	.6566
Fiscal year 1912...	909,596	501,065.72	.5564	25,560.51	.0284	526,626.23	.5818
Total to June 30, 1912.....	1,098,273	621,779.86	.5661	34,648.63	.0316	656,428.49	.5977
Plant—							
Amount to be absorbed after June 30, 1912....		354,256.64				354,256.64	
Total.....		976,036.50		34,648.63		1,010,685.13	
Dredging excavation:							
Prism—							
May 4, 1904, to							
June 30, 1909...	16,180,107	3,427,748.61	.2118	277,360.96	.0172	3,705,109.57	.2290
Fiscal year 1910...	6,857,223	1,650,894.38	.2408	156,092.09	.0227	1,806,986.47	.2635
Fiscal year 1911...	5,549,642	1,398,087.35	.2519	136,071.78	.0245	1,534,159.13	.2764
Fiscal year 1912...	3,884,287	738,025.36	.1900	68,519.58	.0176	806,544.94	.2076
Total to June 30, 1912.....	32,471,259	7,214,755.70	.2222	638,044.41	.0196	7,852,800.11	.2418
Plant—							
Amount to be absorbed after June 30, 1912....		391,021.51				391,021.51	
Total.....		7,605,777.21		638,044.41		8,243,821.62	
PEDRO MIGUEL DAM.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	4,074	5,241.81	1.2866			5,241.81	1.2866
Fiscal year 1910.....		925.47				925.47	
Fiscal year 1912.....	3,937	5,915.97	1.5026	445.35	.1132	6,361.32	1.6158
Total to June 30, 1912.....	8,011	12,083.25	1.5083	445.35	.0556	12,528.60	1.5639
Dry filling—							
May 4, 1904, to June 30, 1909.....	167,061	71,275.77	.4266	9,985.14	.0598	81,260.91	.4864
Fiscal year 1910.....	93,791	36,205.63	.3860	3,892.31	.0415	40,097.94	.4275
Fiscal year 1911.....		4,658.42		584.55		4,642.97	
Fiscal year 1912.....	321,589	162,084.64	.5040	4,107.42	.0128	166,192.06	.5168
Total to June 30, 1912.....	582,441	273,624.46	.4698	18,569.42	.0319	292,193.88	.5017
Total Pedro Miguel dam.....		285,707.71		19,014.77		304,722.48	

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1912—Continued.

PACIFIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries f o r plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
PEDRO MIGUEL LOCKS.							
Dry excavation:							
May 4, 1904, to June 30, 1909.....	<i>Cubic yds.</i> 720,157	\$508,834.12	\$0.7066	\$76,019.61	\$0.1055	\$584,853.73	\$0.8121
Fiscal year 1910.....	298,500	354,524.81	1.1876	48,521.87	.1626	403,046.68	1.3502
Fiscal year 1911.....	16,423	9,838.84	.5991	966.86	.0589	10,805.70	.6580
Fiscal year 1912.....	95,156	28,714.09	.3018	2,699.30	.0283	31,413.39	.3301
Total to June 30, 1912.....	1,130,236	901,911.86	.7980	128,207.64	.1134	1,030,119.50	.9114
Preparing foundations:							
Fiscal year 1910.....	44,948	126,722.55	2.8193	14,916.60	.3319	141,639.15	3.1512
Fiscal year 1911.....	76,847	182,477.38	2.3746	22,073.06	.2872	204,550.44	2.6618
Fiscal year 1912.....	38,826	84,311.91	2.1715	8,314.88	.2142	92,626.79	2.3857
Total to June 30, 1912.....	160,621	393,511.84	2.4499	45,304.54	.2821	438,816.38	2.7320
Masonry:							
Concrete, plain—							
Fiscal year 1910..	166,869	1,016,107.42	6.0892	86,704.98	.5196	1,102,812.40	6.6088
Fiscal year 1911..	497,802	2,341,652.75	4.7040	138,716.42	.2787	2,480,369.17	4.9827
Fiscal year 1912..	134,193	767,363.31	5.7183	41,391.93	.3085	808,755.24	6.0268
Total to June 30, 1912.....	798,864	4,125,123.48	5.1637	266,813.33	.3340	4,391,936.81	5.4977
Concrete, reenforced—							
Fiscal year 1911..	385	6,830.91	17.7426	773.16	2.0082	7,604.07	19.7508
Fiscal year 1912..	48,677	414,765.14	8.5195	31,361.01	.6443	446,066.15	9.1638
Total to June 30, 1912.....	49,062	421,536.05	8.5919	32,134.17	.6550	453,670.22	9.2469
Total masonry.	847,926	4,546,659.53	5.3621	298,947.50	.3526	4,845,607.03	5.7147
Iron work:							
May 4, 1904, to June 30, 1909.....		108,843.27		8,190.96		117,034.23	
Fiscal year 1910.....		142,491.51		3,834.93		147,326.44	
Fiscal year 1911.....		227,470.23		20,665.80		248,136.03	
Fiscal year 1912.....		100,906.24		19,821.24		120,727.48	
Total to June 30, 1912.....		580,711.25		52,512.93		633,224.18	
Gates:							
Fiscal year 1911.....		6,025.59		878.77		6,904.36	
Fiscal year 1912.....		776,718.78		20,434.97		797,153.75	
Total to June 30, 1912.....		782,744.37		21,313.74		804,058.11	
Back filling:							
Fiscal year 1910.....	9,616	2,737.77	.2847	278.81	.0290	3,016.58	.3137
Fiscal year 1911.....	273,709	106,753.75	.3900	8,619.21	.0315	115,372.96	.4215
Fiscal year 1912.....	349,275	123,456.12	.3535	7,944.35	.0227	131,400.47	.3762
Total to June 30, 1912.....	632,600	232,947.64	.3683	16,842.37	.0266	249,790.01	.3949
Filling center wall:							
Total fiscal year 1912.	21,937	21,131.29	.9633	1,677.84	.0765	22,809.13	1.0398
Electrical machinery:							
Total fiscal year 1912.		168,096.64		6,232.82		174,329.46	
Total Pedro Miguel locks.							
		7,627,714.42		571,039.38		8,198,753.80	
Total Pedro Miguel locks and dam.							
		7,913,422.13		590,054.15		8,503,476.28	

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1912—Continued.

PACIFIC DIVISION—Continued.

	Quantities.	Total division expenses, including arbitraries for plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
PEDRO MIGUEL LOCKS— continued.							
Plant—Amount to be absorbed after June 30, 1912.....	Cubic yds.	\$99,609.46				\$99,609.46	
Total.....		8,013,031.59		\$590,054.15		8,603,085.74	
MIRAFLORES DAMS AND SPILLWAY.							
Miraflores east dam— Dry excavation—Total fiscal year 1912.....		9,874.07		962.67		10,836.74	
Miraflores west dam: Dry excavation— May 4, 1904, to June 30, 1909... Fiscal year 1910..	13,986 550	19,681.84 299.74	\$1.4073 .5450	9.68	\$0.0176	19,681.84 309.42	\$1.4073 .5626
Total to June 30, 1912.....	14,536	19,981.58	1.3746	9.68	.0007	19,991.26	1.3753
Masonry, core wall— Fiscal year 1910..... Fiscal year 1912.....		383.59 84.97		40.92 7.83		429.51 92.80	
Total to June 30, 1912.....		473.56		48.75		522.31	
Dry filling— May 4, 1904, to June 30, 1909... Fiscal year 1910.. Fiscal year 1911.. Fiscal year 1912..	363,418 157,483 295,598 425,125	172,058.40 106,686.04 121,256.20 171,936.83	.4694 .6774 .4102 .4044	22,311.58 12,828.58 8,806.63 8,267.23	.0654 .0815 .0298 .0195	194,369.98 119,514.62 130,062.83 180,204.11	.5348 .7589 .4400 .4239
Total to June 30, 1912.....	1,241,624	571,937.52	.4606	52,214.02	.0121	624,151.54	.5027
Hydraulic filling— Fiscal year 1910..... Fiscal year 1911.. Fiscal year 1912.....		3,665.16 16,674.85 10,094.39		412.70 1,987.59 895.46		4,077.86 18,662.44 10,989.85	
Total to June 30, 1912.....		30,434.40		3,295.75		33,730.15	
Total Miraflores west dam.....		622,827.06		55,568.20		678,395.26	
MIRAFLORES SPILLWAY.							
Iron work—Total fiscal year 1912.....		19,282.32		1,404.89		20,687.21	
Total Miraflores dams and spill- way.....		651,983.45		57,935.76		709,919.21	
MIRAFLORES LOCKS.							
Dry excavation: Diversions— Total fiscal year 1910.....	5,885	2,028.98	.3448			2,028.98	.3448

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1912—Continued.

PACIFIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries f o r plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
MIRAFLORES LOCKS—con.							
Dry excavation—Contd.							
In lock site—							
May 4, 1904, to	<i>Cubic yds.</i>						
June 30, 1909...	1,120,342	\$910,973.87	\$0.8131	\$164,599.98	\$0.1469	\$1,075,573.85	\$0.9600
Fiscal year 1910..	229,793	303,825.88	1.3222	42,925.57	.1868	346,751.45	1.5090
Fiscal year 1911..	247,700	182,758.81	.7378	17,645.43	.0712	200,404.24	.8090
Fiscal year 1912..	624,747	410,197.14	.6566	31,729.05	.0508	441,926.19	.7074
Total to June							
30, 1912.....	2,222,582	1,807,755.70	.8133	256,900.03	.1156	2,064,655.73	.9289
Dredging excavation:							
May 4, 1904, to June							
30, 1909.....	167,888	57,408.31	.3418	6,587.95	.0393	63,996.26	.3811
Fiscal year 1910.....	141,759	71,784.25	.5063	6,599.15	.0466	78,383.40	.5529
Total to June 30,							
1912.....	309,647	129,192.56	.4172	13,187.10	.0426	142,379.66	.4598
Hydraulic excavation:							
Total fiscal year 1911..	332,703	182,526.79	.5486	12,772.23	.0384	195,299.02	.5870
Preparing foundations:							
Excavation—							
Fiscal year 1910..	64,036	124,669.74	1.9469	15,952.08	.2491	140,621.82	2.1960
Fiscal year 1911..	137,752	221,569.09	1.6085	27,351.86	.1985	248,920.95	1.8070
Fiscal year 1912..	165,145	258,894.68	1.5677	23,853.75	.1444	282,748.43	1.7121
Total to June							
30, 1912.....	366,933	605,133.51	1.6492	67,157.69	.1830	672,291.20	1.8322
Piling (linear feet)—							
Total fiscal year							
1912.....	6,580	50,264.36	7.6390	3,582.18	.5444	53,846.54	8.1834
Masonry:							
Concrete, plain—							
Fiscal year 1910..	1,630	12,050.56	7.3929	1,173.62	.7200	13,224.18	8.1129
Fiscal year 1911..	272,933	1,278,048.03	4.6826	85,998.07	.3151	1,364,046.10	4.9977
Fiscal year 1912..	729,096	3,344,155.62	4.5867	163,285.44	.2240	3,507,441.06	4.8107
Total to June							
30, 1912.....	1,003,659	4,634,254.21	4.6174	250,457.13	.2495	4,884,711.34	4.8669
Concrete, reinforced—							
Total fiscal year							
1912.....	22,444	238,776.94	10.6388	18,341.91	.8172	257,118.85	11.4560
Total masonry.....	1,026,103	4,873,031.15	4.7491	268,799.04	.2619	5,141,830.19	5.0110
Ironwork:							
Fiscal year 1910.....		92,950.46		2,490.41		95,440.87	
Fiscal year 1911.....		413,153.74		34,433.35		447,587.09	
Fiscal year 1912.....		232,241.41		29,325.29		261,566.70	
Total to June 30,							
1912.....		738,345.61		66,249.05		804,594.66	
Gates:							
Total fiscal year 1912		129,400.09		22,899.20		152,299.29	
Back filling:							
May 4, 1904, to June							
30, 1909.....	409,211	36,801.83	.0899	6,246.87	.0158	43,048.70	.1052
Fiscal year 1910.....	121,080	52,170.32	.4309	6,741.18	.0557	58,911.50	.4866
Fiscal year 1911.....	53,521	22,976.42	.4293	2,557.17	.0478	25,533.59	.4771
Fiscal year 1912.....	442,774	184,794.90	.4174	11,574.39	.0261	196,369.29	.4435
Total to June 30,							
1912.....	1,026,586	296,743.47	.2891	27,119.61	.0264	323,863.08	.3155

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1912.—Continued.

PACIFIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries f o r plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
MIRAFLORES LOCKS—con.							
Filling center wall:	<i>Cubic yds.</i>						
Total fiscal year 1912	7,912	\$8,011.43	\$1.0126	\$403.09	\$0.0509	\$8,414.52	\$1.0635
Electrical machinery:							
Total fiscal year 1912		160,565.32	.....	6,494.50	.....	167,059.82	.....
Total Miraflores locks.....		8,982,998.97	.....	745,563.72	.....	9,728,562.69	.....
Total Miraflores locks and dams..		9,634,982.42	.....	803,499.48	.....	10,438,481.90	.....
LA BOCA LOCKS AND DAMS.							
(Subsequently a b a n - doned owing to change of plans.)							
Dry excavation:							
Total May 4, 1904, to June 30, 1909....	78,233	131,254.40	1.6777	27,088.89	.3463	158,343.29	2.0240
Construction:							
Dam—Total May 4, 1904, to June 30, 1909.....		288,601.56	.....	26,748.51	.....	315,350.07	.....
Locks—Total May 4, 1904, to June 30, 1909.....		145,828.37	.....	13,478.03	.....	159,306.40	.....
Total La Boca locks and dams..		565,684.33	.....	67,315.43	.....	632,999.76	.....
Total lower locks and dams, Pacific entrance.....		10,200,666.75	.....	870,814.91	.....	11,071,481.66	.....
Plant—Amount to be absorbed after June 30, 1912.....		428,321.49	.....	.....	.....	428,321.49	.....
Total.....		10,628,988.24	.....	870,814.91	.....	11,499,803.15	.....
NAOS ISLAND BREAK- WATER. ¹							
Fiscal year 1910.....		36,847.73	.....	20.03	.....	36,867.76	.....
Fiscal year 1911.....		21,238.30	.....	.....	.....	21,238.30	.....
Fiscal year 1912.....		134,839.41	.....	.....	.....	134,839.41	.....
Total to June 30, 1912.....	782,021	192,925.44	.2467	20.03	.....	192,945.47	.2467
TERMINAL FACILITIES, BALBOA.							
Preliminary work:							
Fiscal year 1911.....		16,277.26	.....	2,114.44	.....	18,391.70	.....
Fiscal year 1912.....		² 1,175.16	.....	257.48	.....	² 917.68	.....
Total to June 30, 1912.....		15,102.10	.....	2,371.92	.....	17,474.02	.....
Preparing site:							
General—							
Fiscal year 1911.....		4,547.08	.....	478.49	.....	5,025.57	.....
Fiscal year 1912..		27,200.94	.....	1,004.22	.....	28,205.16	.....
Total to June 30, 1912.....		31,748.02	.....	1,482.71	.....	33,230.73	.....

¹ Constructed by central division; charges represent extra cost of dumping material at this point.² Denotes credit.

EXHIBIT A.—STATEMENT OF CONSTRUCTION EXPENDITURES TO JUNE 30, 1912—Con.

TABLE 3.—Statement of construction expenditures to June 30, 1912.—Continued.

PACIFIC DIVISION—Continued.

	Quantities.	Total division ex- penses, including arbitraries f o r plant.		Administrative and general expenses.		Total cost.	
		Amount.	Unit cost.	Amount.	Unit cost.	Amount.	Unit cost.
TERMINAL FACILITIES, BALBOA—continued.							
Preparing site—Contd.							
Excavation—Total fiscal year 1912.....	<i>Cubic yds.</i> 23,140	\$19,785.26	\$0.8550	\$1,687.36	\$0.0729	\$21,472.62	\$0.9279
Filling—Total fiscal year 1912.....	23,140	10,739.54	.4641	826.56	.0357	11,566.10	.4998
Total preparing site.....		62,272.82		3,996.63		66,269.45	
Yards and tracks—Total fiscal year 1912.....		6,421.98		601.57		7,023.55	
Dredging inner basin— Total fiscal year 1912...	370,607	58,549.14	.1580	5,594.70	.0151	64,143.84	.1731
Main dry dock:							
Fiscal year 1911.....		1,563.65		192.16		1,755.81	
Fiscal year 1912.....		10,157.81		921.13		11,078.94	
Total to June 30, 1912.....		11,721.46		1,113.29		12,834.75	
Coaling plant—Total fiscal year 1912.....		1,237.89		124.16		1,362.05	
Permanent shops—Total fiscal year 1912.....		116.19		9.43		125.62	
Docks—Total fiscal year 1912.....		3,653.35				3,653.35	
Total terminal fac- ilities, Balboa.....		159,074.93		13,811.70		172,886.63	
Plant—Amount to be absorbed after June 30, 1912.....		53,505.88				53,505.88	
Total.....		212,580.81		13,811.70		226,392.51	
MANUFACTURING PLANTS.							
Amounts to be absorbed after June 30, 1912:							
Electric power plant.....		262,364.40				262,364.40	
Ancon rock quarry.....		214,647.89				214,647.89	
Chame sand plant.....		159,422.15				159,422.15	
Total.....		636,434.44				636,434.44	
Total Pacific divi- sion.....		29,485,718.61		2,225,576.34		31,711,294.95	
LIGHTS AND BUOYS.							
Fiscal year 1911.....		12,055.85		2,319.03		14,374.88	
Fiscal year 1912.....		102,364.12		9,255.81		111,619.93	
Total to June 30, 1912.....		114,419.97		11,574.84		125,994.81	
Plant—Amount to be ab- sorbed after June 30, 1912.....		24,233.73				24,233.73	
Total lights and buoys.....		138,653.70		11,574.84		150,228.54	
Total construction cost.....		139,587,051.06		12,711,191.70		152,298,242.76	

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912.

TABLE 1.—*Dry excavation.*

ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
PRISM.													
Dry excavation.....cubic yards..	58, 125	65, 041	74, 487	65, 919	54, 719	50, 199	33, 165	23, 217					424, 872
Drilling.....	\$0. 0438	\$0. 0341	\$0. 0041	\$0. 0130	\$0. 0049	\$0. 0495	\$0. 146	\$0. 353					\$0. 0174
Blasting.....	.1225	.0779	.0421	.0182	.0083	.0522	.0396	.0048					.0494
Loading.....	.0791	.0453	.0444	.0444	.0577	.0607	.0635	.0683					.0564
Tracks.....	.0966	.0707	.0841	.0750	.0581	.0730	.0166	.0217					.0487
Transportation.....	.1410	.1337	.1268	.1131	.1333	.1206	.1279	.1297					.1280
Pumps.....		.0115	.0204	.0233	.0322	.0246	.0210	.0343					.0202
Maintenance of equipment.....	.0744	.1330	.0426	.0508	.0640	.0514	.2329	.0471					.0754
Plant arbitrary.....	.1190	.2724	.2000	.2000	.2000	.2000	.0600	.0600					.1314
Division expense.....	.0238	.0238	.0175	.0143	.0142	.0180	.0111	.0150					.0183
Total division cost.....	.7002	.8024	.5820	.5521	.5727	.6500	.5580	.3456					.5952
Administrative and general expense...	.0615	.0476	.0332	.0241	.0357	.0485	.0302	.0360					.0406
Total cost.....	.7617	.8500	.6152	.5762	.6084	.6985	.5882	.3816					.6358
GATUN SPILLWAY.													
Preparing foundations, excavation, cubic yards	903	742	576	112			1, 330	1, 228	254		1, 130	848	7, 123
Blasting.....	\$0. 1979	\$0. 4177	\$0. 4086	\$0. 3696									\$0. 0004
Loading by power.....	.8956	1. 8574	2. 0109	4. 4843					\$1. 1089				.2031
Loading by hand.....	.0410						\$1. 0837	.6879	1. 1215		\$1. 1587	\$1. 3146	1. 3354
Transportation.....													.0052
Tracks.....		.0544	.1805								.0114		.0223
Coffer dams	.2680	.8150	.0779	.0089			.8510	.0947	.1884		.0382	.0007	.7606
Maintenance of equipment.....	.2173			.4813				.0065	.0005		.0065		.0471
Plant arbitrary.....	.1190	.2986	.2000	.2000			.0600	.0600	.0600		.0600	.0600	.1081
Division expense.....	.1314	.2516	.2195	.3604			.1199	.0508	.0883		.1007	.1416	.1578
Total division cost.....	1. 8702	3. 6947	3. 0974	5. 9045			2. 1146	1. 0505	2. 5676		1. 3755	1. 5169	2. 6400
Administrative and general expense...	.1779	.3500	.3206	.5945			.1967	.1123	.2747		.1717	.1569	.2643
Total cost.....	2. 0481	4. 0447	3. 4180	6. 4990			2. 3113	1. 1628	2. 8423		1. 5472	1. 6738	2. 9043

¹ Denotes credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 1.—*Dry excavation*—Continued.

ATLANTIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN LOCKS.													
Preparing foundations, excavation, cubic yards.....	5,994	1,191	1,703										8,888
Drilling.....	\$0.3009	\$0.4204	\$0.2948										\$0.3157
Blasting.....	.2328	.2341	.0086										.1900
Loading by power.....	.0567	.0722											.0479
Loading by hand.....	.7793	2.7753	1.6571										1.2150
Transportation.....	.2382	.2002	.1383										.2139
Tracks.....	.0015	.0520	.0639										.0203
Pumps.....	.0927	.5759											.1397
Maintenance of equipment.....	.1322	.1125	.4738										.4388
Plant arbitrary.....	.1190	.6076	.2000										.2000
Division expense.....	.1379	.3819	.1789										.1785
Total division cost.....	2,0912	5,4321	3,0154										2,9598
Administrative and general expense.....	.1909	.5193	.2612										.2484
Total cost.....	2,2821	5,9514	3,2766										3,2082
PERMANENT POWER HOUSE, GATUN.													
Excavation.....cubic yards.....		20,625	1,210								22,981	27,303	72,119
Clearing.....		\$0.0034	\$0.0074								\$0.0101		\$0.0046
Drilling.....			.2861										.0048
Blasting.....			.0275										.0004
Loading.....		.0313	.0486								.0339	\$0.0359	.0342
Tracks.....		.0676	.5043								.0700	.0407	.0655
Transportation.....		.1392	.0751								.0627	.0669	.0864
Maintenance of equipment.....		.0958	.0505								.0463	.0549	.0638
Plant arbitrary.....		.2000	.2000								.0600	.0600	.1024
Division expense.....		.0171	.0752								.0122	.0120	.0146
Total division cost.....		.5544	1.2747								.2961	.2704	.3767
Administrative and general expense.....		.0290	.1122								.0219	.0131	.0221
Total cost.....		.5834	1.3869								.3180	.2835	.3988

CENTRAL DIVISION.

PRISM.		1, 337, 833	1, 442, 402	1, 340, 173	1, 306, 971	1, 209, 498	1, 351, 082	1, 435, 853	1, 404, 902	1, 702, 169	1, 617, 195	1, 412, 380	1, 357, 204	16, 917, 662
Dry excavation.....	cubic yards..													
Clearing.....					\$0. 0004			\$0. 0001	\$0. 0002					\$0. 0001
Drilling.....		\$0. 0556	\$0. 0625	\$0. 0533	.0643		\$0. 0578	.0555	.0494	\$0. 0439	\$0. 0455	\$0. 0478	\$0. 0489	.0535
Blasting.....		.0656	.0682	.0636	.0614		.0705	.0704	.0617	.0567	.0504	.0557	.0557	.0622
Loading.....		.0496	.0458	.0539	.0516	.0641	.0498	.0486	.0515	.0446	.0480	.0519	.0519	.0492
Tracks.....		.0858	.0906	.1323	.1113	.1028	.1066	.0934	.0824	.0733	.0606	.0736	.0617	.0885
Transportation.....		.0740	.0717	.0610	.0779	.0928	.0758	.0599	.0757	.0653	.0701	.0847	.0770	.0734
Dumps.....		.0460	.0525	.0447	.0528	.0574	.0543	.0477	.0438	.0428	.0441	.0496	1.0277	.0423
Pumps.....		.0044	.0049	.0037	.0048	.0035	.0040	.0037	.0040	.0037	.0065	.0032	.0025	.0041
Maintenance of equipment.....		.0814	.0831	.0844	.1015	.0938	.0885	.0798	.0931	.0794	.0724	.0835	.0757	.0843
Plant arbitrary.....		.0500	.0500	.0500	.0500	.0500	.0500	.0300	.0300	.0300	.0300	.0300	.0300	.0304
Division expense.....		.0155	.0167	.0154	.0144	.0133	.0130	.0128	.0113	.0101	.0255	.0138	.0114	.0145
Total division cost.....		.5279	.5460	.5683	.5904	.5910	.5652	.5019	.5031	.4498	.4531	.4938	.3871	.5115
Administrative and general expense.....		.0437	.0369	.0405	.0374	.0459	.0354	.0347	.0370	.0283	.0305	.0373	.0336	.0364
Total cost.....		.5716	.5829	.6088	.6278	.6369	.6006	.5366	.5401	.4781	.4836	.5311	.4207	.5479
Dry excavation, prism, by contract, cubic yards.....		22, 284	21, 892	21, 272	12, 216	12, 248	10, 809	8, 539	10, 812	10, 056	9, 752	5, 904		145, 784
Contract cost.....		\$0. 2888	\$0. 3048	\$0. 3007	\$0. 2919	\$0. 3098	\$0. 3130	\$0. 3555	\$0. 3400	\$0. 3143	\$0. 2983	\$0. 3013		\$0. 3056
Plant arbitrary.....		.0500	.0500	.0500	.0500	.0500	.0500	.0300	.0300	.0300	.0300	.0300		.0438
Total cost.....		.3388	.3548	.3507	.3419	.3598	.3630	.3855	.3700	.3443	.3283	.3313		.3494
Total dry excavation.....	cubic yards..	1, 360, 117	1, 464, 294	1, 361, 445	1, 319, 187	1, 221, 746	1, 361, 891	1, 444, 392	1, 415, 714	1, 712, 225	1, 626, 947	1, 418, 284	1, 357, 204	17, 063, 446
Unit cost.....		\$0. 5678	\$0. 5795	\$0. 6048	\$0. 6252	\$0. 6341	\$0. 5988	\$0. 5355	\$0. 5388	\$0. 4773	\$0. 4826	\$0. 5302	\$0. 4207	\$0. 5462

¹ Denotes credit.

The credit shown in June, under "Dumps," Central division, is due to credit for excess cost of dumping excavated material at Naos Island Breakwater from October, 1908, to June, 1912, inclusive, \$96,347.25. Eliminating this credit, "Dumps" would show a cost of \$0.0433 for June, and "Total cost" for June would be \$0.4916."

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.
TABLE 1.—Dry excavation—Continued.
PACIFIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
PRISM.													
Dry excavation.....cubic yards..	43,799	54,164	37,097	20,980	19,178	36,040	48,406	70,646	118,950	152,754	140,163	122,298	864,475
Clearing.....													
Drilling.....	\$0.0542	\$0.0311	\$0.0365	\$0.0645	\$0.1592	\$0.0951	\$0.0725	\$0.0335	\$0.0001	\$0.0645	\$0.0927	\$0.1131	\$0.0027
Blasting.....	.0343	.0184	.0128	.0344	.0716	.0738	.0570	.0379	.0513	.0289	.0524	.0382	.0825
Loading.....	.1248	.1014	.2112	.0538	.1433	.1159	.0993	.1110	.1146	.0895	.0977	.1304	.1116
Tracks.....	.1482	.1072	.1355	.0800	.1338	.1200	.1035	.1380	.2213	.1034	.0944	.1752	.1359
Transportation.....	.0830	.0657	.0593	.0901	.0780	.0765	.0723	.0654	.0665	.0452	.0529	.0747	.0637
Dumps.....	.0226	.0196	.0260	.0055	.....	.0106	.0153	.0002	.0009	.....	.0003	.....	.0043
Pumps.....	.0224	.0212	.0367	.0377	.0210	.0248	.....	.0355	.0496	.0554	.0376	.0337	.0377
Maintenance of equipment.....	.0489	.0659	.0891	.0806	.1116	.1030	.0993	.0606	.0566	.0480	.0830	.1032	.0740
Plant arbitrary.....	.1300	.1303	.1301	.1307	.1300	.1300	.1900	.1900	.1918	.1937	.1900	.1032	.1762
Division expense.....	.0288	.0232	.0279	.0260	.0270	.0267	.0229	.0228	.0196	.0180	.0200	.0290	.0228
Total division cost.....	.6972	.5840	.7651	.6033	.8755	.7764	.7321	.7819	.8711	.6466	.7210	.8875	.7527
Administrative and general expense.....	.0502	.0364	.0562	.0499	.0661	.0454	.0346	.0422	.0455	.0307	.0403	.0553	.0432
Total cost.....	.7474	.6204	.8213	.6532	.9416	.8218	.7667	.8241	.9166	.6773	.7613	.9428	.7959
PEDRO MIGUEL LOCKS.													
Dry excavation.....cubic yards..					5,161	10,000	20,490	17,215	920	12,863	24,433	4,074	95,156
Drilling.....													
Loading by power.....													
Tracks.....					\$0.1642	\$0.1408	\$0.1029	\$0.0731	\$0.1437	\$0.0532	\$0.0509	\$0.2167	\$0.0001
Transportation.....					.1364	.0751	.0734	.0110	.0235	.0179	.0362	.4673	.0943
Dumps.....					.0970	.0774	.0016	.0492	.0501	.0343	.0385	.0848	.0650
Pumps.....					.0084	.....	.....	.....	.....	.....	.0009	.0030	.0008
Maintenance of equipment.....					.0432	.0378	.0293	.0152	.0161	.0090	.0338	1,1167	.0204
Plant arbitrary.....					.1235	.1084	.0687	.0416	.0412	.0284	.0553	.1037	.0633
Division expense.....					.0012	.0013	.....	.....	.....	.....	.....	.....	.0002
Total division cost.....					.0236	.0192	.0121	.0073	.0103	.0065	.0093	.0471	.0126
Administrative and general expense.....					.5975	.4600	.2880	.1974	.2849	.1493	.2249	.8059	.3018
Total cost.....					.6531	.0336	.0269	.0176	.0284	.0130	.0228	.1161	.0283
Preparing foundations, excavations, cubic yards.....					.6506	.4936	.3149	.2150	.3133	.1632	.2477	.9220	.3301
Total cost.....													
Preparing foundations, excavations, cubic yards.....	6,273	684	3,008	5,365	7,801	6,170	3,484	1,265	857	406	632	2,881	38,826

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 1.—*Dry excavation*—Continued.

PACIFIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
MIRAFLORES LOCKS—continued.													
Preparing foundations, excavation, cubic yards.....	2,420	2,940	2,577	5,144	25,555	27,480	22,519	17,359	20,265	20,864	12,226	5,796	165,145
Drilling.....	\$0.3420			\$0.0003	\$0.0967	\$0.0942	\$0.0640	\$0.1090	\$0.0637	\$0.1046	\$0.1839		\$0.0905
Blasting.....	.4265				.0497	.0718	.0505	.0475	.0330	.0469	.0240		.0495
Loading by power.....					.0992	.0823	.0624	.0530	.0523	.0730	.0343		.0615
Loading by hand.....	1.9883	\$1.6607	\$1.4140	1.8934	.3834	.5220	.7043	1.0248	.8048	.6299	.7659	\$0.0054	.7859
Transportation.....	.3906	.2415	.1543	.0672	.0640	.0839	.0629	.0528	.0813	.0303	.0465	.1270	.0742
Tracks.....	.0821	.0380	.2791	.1854	.1122	.2421	.1653	.1725	.0717	.1393	.0751	.0311	.1434
Dumps.....				.0034		.0405	.0259	.0490	.0572	.0288	.0142		.0272
Pumps.....	.0218	.0211	.0522	.0831	.0701	.1311	.0897	.1240	.0347	.0865	.1107	.2422	.0941
Maintenance of equipment.....	.1938	.1067	.3083	.1206	.1167	.1348	.1250	.0694	.0675	.0986	.1249	.1605	.1138
Plant arbitrary.....	.0600	.0235	.0400	.0383	.0403	.0400	.0600	.0600	.0600	.0600	.0600	.0600	.0320
Division expense.....	.2309	.1438	.1002	.1141	.0457	.0689	.0721	.0876	.0589	.0718	.0737	.1445	.0756
Total division cost.....	3.7360	2.2353	2.3481	2.5108	1.0780	1.5116	1.4821	1.8496	1.3851	1.3697	1.5152	2.5144	1.5677
Administrative and general expense.....	.3479	.2028	.2067	.2256	.1062	.1117	.1352	.1795	.1291	.1256	.1595	.2728	.1444
Total cost.....	4.0839	2.4381	2.5548	2.7364	1.1842	1.6233	1.6173	2.0291	1.5142	1.4953	1.6747	2.7872	1.7121

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS, FISCAL YEAR 1912—Continued.

TABLE 2.—Dredging excavation.

ATLANTIC DIVISION.

Items.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	
	Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		Cu. yds.		
PRISM					420,434	\$0.0016	470,400	\$0.0008	742,242	\$0.0003	533,409	\$0.0008	438,993	\$0.0007	362,088	\$0.0008	184,608	\$0.0011	253,572	\$0.0012	329,626		343,804		4,870,827	\$0.0006	
Clearing...																											
Seagoing suction dredges:																											
Operation...	298,778	\$0.0399	265,542	\$0.0384	293,621	.0312	121,440	.0276	301,201	.0317	291,669	.0375	294,120	.0344	210,786	.0445	40,633	.0232	137,256	.0448	247,835	\$0.0458	252,974	\$0.0442	2,755,255	.0378	
Repairs...	298,778	.0024	265,542	.0051	293,621	.0026	121,440	.1698	301,201	.0033	291,669	.0019	294,120	.0057	210,786	.0102	40,633	.6856	137,256	.0781	247,835	.0115	252,974	.0066	2,755,255	.0259	
Small ladder dredges:																											
Operation...	88,300	.0825	61,212	.0907	66,304	.0638	107,031	.0698	117,925	.0550	97,965	.0649	104,637	.0751	101,578	.0739	100,308	.0715	42,118	.0991	58,683	.1325	58,057	.0973	1,004,118	.0772	
Repairs...	88,300	.2098	61,212	.1393	66,304	.1218	107,031	.0197	117,925	.0356	97,965	.0574	104,637	.0302	101,578	.0221	100,308	.0183	42,118	.4208	58,683	.0099	58,057	.1358	1,004,118	.0790	
Dipper dredges:																											
Operation...	37,117	.1329	40,702	.1131	60,509	.1140	63,591	.1043	65,577	.0894	62,132	.1007	41,969	.1525	49,724	.1167	44,267	.1348	74,198	.0933	23,108	.1131	32,773	.1006	595,607	.1111	
Repairs...	37,117	.4367	40,702	.3132	60,509	.1094	63,591	.1333	65,577	.1095	62,132	.0567	41,969	.0991	49,724	.0849	44,267	.1851	74,198	.0733	23,108	.0452	32,773	.2373	595,607	.1437	
Pipe-line dredges:																											
Operation...							178,338	.0433	257,539	.0308	81,643	.0916	² 1,733	¹ 1,2780											515,787	.0424	
Repairs...							178,338	.0261	257,539	.0158	81,643	.1141	² 1,733												515,787	.0705	
Pipe lines...	125,417	.0822	101,914	.0912	126,813	.0625	178,338	.0601	257,539	.0021	81,643	.0118													515,787	.0127	
Dikes...	125,417	.0394	101,914	.0472	126,813	.0347	178,338	¹ .0072	257,539		81,643	.0395													515,787	.0125	
Tugs, chaps, and screws:																											
Operation...	24,725	.1129	43,300	.0800	39,540	.1062	170,622	.0591	183,502	.0654	160,097	.0822	146,606	.0899	151,302	.0838	144,575	.0865	116,316	.1246	81,791	.0017	90,830	.1002	1,599,785	.0811	
Repairs...	24,725	.2644	43,300	.1605	39,540	.1686	170,622	.0473	183,502	.0540	160,097	.0613	146,606	.0874	151,302	.0649	144,575	.0409	116,316	.0562	81,791	.2873	90,830	.1208	1,599,785	.0698	
Drilling...							37,747	.1178	38,980	.0873	49,385	.0235	21,888	.1969	40,928	.1163	47,981	.1707	76,540	.0977	73,090	.0488	77,733	.0412	574,837	.0897	
Blasting...							37,747	.1763	38,980	.1159	49,385	.0768	24,888	.1656	40,928	.1802	47,981	.0733	76,540	.1036	73,090	.0950	77,733	.0829	574,837	.1321	
Small boats...	424,105	.0026	367,456	.0039	420,434	.0039	470,400	.0019	742,242	.0015	533,409	.0020	438,993	.0023	362,088	.0023	184,608	.0057	253,572	.0044	329,626	.0026	343,804	.0023	4,870,827	.0024	
Repairs, miscellaneous equipment...	424,105	.0041	367,456	.0004	420,434	.0037	470,400	.0009	742,242	.0007	533,409	.0010	438,993	.0010	362,088	.0015	184,608	.0048	253,572	.0036	329,626	.0017	343,804	.0020	4,870,827	.0018	
Plant arbitrary...	424,105	.0010	367,456	.0265	420,434	.0450	470,400	.0450	742,242	.0450	533,409	.0557	438,993	.0557	362,088	.0470	184,608	.0263	253,572	.0470	329,626	.0470	343,804	.0470	4,870,827	.0458	
Division expense...	424,105	.0074	367,456	.0087	420,434	.0067	470,400	.0075	742,242	.0034	533,409	.0051	438,993	.0088	362,088	.0071	184,608	.0185	253,572	.0157	329,626	.0057	343,804	.0112	4,870,827	.0077	
Total division cost	424,105	.2744	367,456	.2238	420,434	.2079	470,400	.2454	742,242	.1541	533,409	.2079	438,993	.2022	362,088	.2626	184,608	.5580	253,572	.4123	329,626	.2516	343,804	.1757	4,870,827	.2481	
Administrative and general expense...	424,105	.0236	367,456	.0292	420,434	.0170	470,400	.0132	742,242	.0118	533,409	.0167	438,993	.0246	362,088	.0226	184,608	.0438	253,572	.0329	329,626	.0180	343,804	.0227	4,870,827	.0207	
Total cost...	424,105	.2980	367,456	.2530	420,434	.2249	470,400	.2586	742,242	.1659	533,409	.2246	438,993	.3168	362,088	.2852	184,608	.6018	253,572	.4752	329,626	.2696	343,804	.1984	4,870,827	.2688	
Earth excavation...	per cent	399,470	94.17	324,156	88.22	380,894	90.40	432,653	91.98	703,262	94.75	484,024	90.74	414,105	94.33	321,160	88.70	136,627	74.01	177,632	69.82	256,516	77.83	260,071	77.39	4,205,090	88.20
Rock excavation...	do	24,725	5.83	43,300	11.78	39,540	9.40	37,74	8.01	38,980	5.2	49,385	9.16	24,888	5.67	40,928	11.30	47,981	25.99	76,540	30.18	73,090	22.17	77,733	22.61	574,837	11.80
GATUN LOCKS																											
Dredging excavation															219,311		325,253		150,044		100,530		88,780		883,018		
Suction dredges:																											
Operation...																											
Repairs...																											
Pipe lines...																											
Collardans...																											
Dikes...																											
Drilling...																											
Blasting...																											
Plant arbitrary...																											
Division expense...																											
Total division cost																											
Administrative and general expense																											
Total cost...																											

¹ Denotes credit.

² Charged to dredging excavation—prism in error.

Low total cost in June is due to credit of \$28,466.19 to "Dikes," being proportion chargeable to dredging excavation in Gatun Lock site.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS, FISCAL YEAR 1912—Continued.

TABLE 2.—*Dredging excavation*—Continued.

PACIFIC DIVISION.

Items.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.	
	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.	Quantities.	Unit cost.
REBM.																										
Seagoing suction dredge:	<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>		<i>Cu. yds.</i>	
Operation.....	180,565	\$0.0600	212,002	\$0.0544	259,755	\$0.0381	209,244	\$0.0547	209,530	\$0.0450	10,498	\$0.0672	187,889	\$0.0473	252,143	\$0.0394	267,542	\$0.0409	230,878	\$0.0461	160,251	\$0.0576	187,208	\$0.0602	2,376,505	\$0.0485
Repairs.....	180,565	.0147	212,002	.0220	259,755	.0087	209,244	.0096	209,530	.0169	10,498	2.3586	187,889	.0326	252,143	.0100	267,542	.0100	230,878	.0049	160,251	.0247	187,208	.0127	2,376,505	.0247
Small ladder dredges:																										
Operation.....	181,355	.0501	225,884	.0488	185,775	.0514	45,458	.0906	47,452	.0902	40,761	.1431	56,632	.1119	92,492	.1059	35,829	.1765	35,348	.1101	15,858	.1536	29,148	.1882	991,992	.0788
Repairs.....	181,355	.0112	225,884	.0134	185,775	.0303	45,458	.1660	47,452	.0460	40,761	.0420	56,632	.0295	92,492	.0286	35,829	.0337	35,348	.0445	15,858	.0331	29,148	.0509	991,992	.0315
5-yard ladder dredge:																										
Operation.....																										
Repairs.....																										
Dipper dredges:																										
Operation.....	80,000	.0519	42,429	.0790	18,848	.2401	22,022	.1717	38,544	.1040	32,150	.1279	29,912	.1268	27,246	.1225	27,312	.1376	14,201	.1546	10,250	.1595	19,250	.1742	362,164	.1160
Repairs.....	80,000	.0418	42,429	.0780	18,848	.0492	22,022	.1057	38,544	.0928	32,150	.0584	29,912	.0726	27,246	.0989	27,312	.0702	14,201	.3516	10,250	.4070	19,250	.2231	362,164	.0983
Tugs, chapsels, and scows:																										
Operation.....	261,355	.0576	268,313	.0638	204,623	.0663	67,480	.1225	85,996	.0596	72,911	.0580	86,544	.0614	119,738	.0786	63,141	.0569	64,390	.0592	141,169	.0652	72,122	.0980	1,507,782	.0675
Repairs.....	261,355	.0150	268,313	.0195	204,623	.0223	67,480	.1154	85,996	.0284	72,911	.0079	86,544	.0209	119,738	.0236	63,141	.0265	64,390	.0068	141,169	.0129	72,122	.0108	1,507,782	.0232
Drilling.....	5,675		13,425		21,187		26,709		33,975		48,030	1.0008														
Blasting.....	5,675	.2732	13,425		21,187		26,709		33,975	.0009	48,030	.0001	35,745	.0011												
Operation, drill barges.....	5,675	2.1645	13,425	.7558	21,187	.4788	26,709	.3965	33,975	.2575	48,030	.1673	35,745	.2728	51,922	.1968	38,436	.2230	24,824	.3864	78,501	.1214	31,787	.3094	410,216	.2869
Operation, rock breakers.....	5,675	.2382	13,425	.0819	21,187	.0497	26,709	.0470	33,975	.0327	48,030	.0341	35,745	.0387	51,922	.0224	38,436	.0399	24,824	.0609	78,501	.0178	31,787	.0341	410,216	.0381
Small boats.....	450,920	.0025	480,315	.0028	464,378	.0020	276,724	.0039	295,526	.0027	83,409	.0069	274,433	.0057	371,881	.0045	330,683	.0042	295,268	.0043	301,420	.0054	250,330	.0079	3,884,287	.0040
Repairs, miscellaneous equipment.....	450,920	.0038	480,315	.0045	464,378	.0029	276,724	.0059	295,526	.0108	83,409	.0152	274,433	.0073	371,881	.0098	330,683	.0246	295,268	.0144	301,420	.0055	250,330	.0072	3,884,287	.0085
Plant arbitrary.....	450,920		480,315		464,378		276,724		295,526		83,409		274,433		371,881		330,683		295,268		301,420		250,330		3,884,287	
Division expense.....	450,920	.0055	480,315	.0060	464,378	.0042	276,724	.0076	295,526	.0048	83,409	.0184	274,433	.0049	371,881	.0049	330,683	.0034	295,268	.0053	301,420	.0054	250,330	.0072	3,884,287	.0056
Total division cost.....	450,920	.1602	480,315	.1601	464,378	.1429	276,724	.2310	295,526	.1703	83,409	.6814	274,433	.1901	371,881	.1688	330,683	.1599	295,268	.1991	301,420	.2109	250,330	.2362	3,884,287	.1900
Administrative and general expense.....	450,920	.0157	480,315	.0137	464,378	.0133	276,724	.0243	295,526	.0170	83,409	.0524	274,433	.0141	371,881	.0125	330,683	.0155	295,268	.0216	301,420	.0211	250,330	.0234	3,884,287	.0176
Total cost.....	450,920	.1759	480,315	.1738	464,378	.1562	276,724	.2553	295,526	.1873	83,409	.7338	274,433	.2042	371,881	.1813	330,683	.1754	295,268	.2207	301,420	.2323	250,330	.2596	3,884,287	.2076
Earth excavation..... per cent.....	445,245	98.74	466,890	97.20	443,191	95.44	250,015	90.35	261,551	88.50	35,379	42.42	238,688	86.97	319,959	86.04	292,247	88.38	270,444	91.59	222,919	73.96	227,543	87.74	3,474,071	89.44
Rock excavation..... do.....	5,675	1.26	13,425	2.80	21,187	4.56	26,709	9.65	33,975	11.50	48,030	57.58	35,745	13.03	51,922	13.96	38,136	11.62	24,824	8.41	78,501	26.04	31,787	12.26	410,216	10.56

¹ Denotes credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 3.—Hydraulic excavation.

ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
PRISM.													
Hydraulic excavation.....cubic yards..	1,000												1,000
Dredging pumps.....	\$2.4430												\$2.4430
Division expense.....	.1546												.1546
Total division cost.....	2.5976												2.5976
Administrative and general expense.....	.2090												.2090
Total cost.....	2.8066												2.8066

PACIFIC DIVISION.

PRISM.													
Hydraulic excavation.....cubic yards..	69,772	149,926	66,289	56,500	50,563	57,780	60,302	60,915	74,256	88,727	\$6,890	78,676	900,596
Clearing.....						\$0.0008					\$0.0041		\$0.0004
Drilling.....			\$0.0229	\$0.0170	\$0.0240	1.0006			\$0.0025				.0043
Blasting.....			.0394	.0236	.0115	.0065			.0007			\$0.0009	.0058
Pumping station.....			.0902	.1191	.1152	.1005	\$0.0021	\$0.0007	.0981	\$0.0706	.0728	.0773	.0840
Pipe lines and monitors.....			.0706	.0226	.0357	.0803	.1216	.0850	.0159	.0258	.0661	.0240	.0513
Dredging pumps.....			.0623	.0849	.1180	.0883	.0546	.0907	.0598	.0593	.0987	.0483	.0634
Relay pumps.....													
Dikes.....			.0339	1.0950	.0145	.0373	.0318	.0266	.0146	.0168	.0270	.0535	.0198
Maintenance of equipment.....			.1000	.1044	.0923	.1213	.0953	.0833	.1267	.0590	.0610	.1281	.0893
Power.....			.1317	.1340	.1368	.1563	.1231	.1231	.1070	.1070	.1261	.1300	.1223
Plant arbitrary.....			.1012	.1031	.1025	.1025	.1080	.1045	.1042	.1038	.1054	.1067	.1027
Division expense.....			.0162	.0201	.0185	.0173	.0141	.0143	.0096	.0094	.0120	.0144	.0131
Total division cost.....	.5492	.3737	.7284	.5448	.6690	.6882	.6734	.5900	.5550	.4517	.5732	.5832	.5564
Administrative and general expense.....	.0307	.0160	.0425	.0336	.0464	.0355	.0308	.0275	.0240	.0185	.0284	.0314	.0284
Total cost.....	.5799	.3897	.7709	.5784	.7154	.7237	.7042	.6265	.5790	.4702	.6016	.6146	.5848

1 Indicates credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 4.—*Masonry.*

ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN SPILLWAY.													
Concrete.....cubic yards..	5,935	5,050	3,650	2,990	2,228	3,364	8,733	10,204	7,806	3,392	1,920	2,622	57,894
Cement.....	\$1.5698	\$1.5662	\$1.6344	\$1.6997	\$1.7817	\$1.7402	\$1.7352	\$1.7465	\$1.8197	\$1.3974	\$1.3301	\$1.2572	\$1.6559
Stone.....	1.6568	2.0334	1.8485	1.8646	1.7399	1.4663	2.0038	2.0648	1.8431	1.7997	2.0610	2.1120	1.8964
Sand.....	.6471	.8037	.7958	.8315	.8267	.9180	1.0625	1.0301	.9552	1.0211	1.0059	1.0147	.9245
Mixing.....	.1824	.2738	.3358	.3601	.5009	.3294	.1966	.2077	.2295	.4102	.5339	.4910	.2820
Total cost.....	4,0561	4,6771	4,6145	4,7559	4,8492	4,4539	4,9981	5,0491	4,8475	4,6284	4,9309	4,8749	4,7588
Large rock.....cubic yards..							90	64					154
Cost.....							\$5.3115	\$1.0984					\$3.5606
Masonry.....cubic yards..	5,935	5,050	3,650	2,990	2,228	3,364	8,823	10,268	7,806	3,392	1,920	2,622	58,045
Concrete.....	\$4.0561	\$4.6771	\$4.6145	\$4.7559	\$4.8492	\$4.4539	\$4.9471	\$5.0177	\$4.8475	\$4.6284	\$4.9309	\$4.8749	\$4.7461
Large rock.....	.5037	1.0274	1.0702	1.4416	1.5250	.9672	.0542	.0068	.4279	.8121	1.2588	1.1495	.0094
Wood forms.....							.5448	.3259					.7360
Steel forms.....							.4358	.3453	.4412	1.0158	1.5413	1.1088	.6287
Placing.....	.4808	.7184	.8467	.6454	1.0206	.7590	.0074			.0500		.0075	.0439
Reenforcements.....	.0622	.2295	.0528	.0164	.0080	.1495				.0071	.0025	.0044	.0041
Pumps.....					.0862		.0006						
Power.....													
Cofferdams.....	.0136	.0399	.0041		.1612	.2033	.0428	.0038	.0021	.0054	.0075	.0001	.0311
Maintenance of equipment.....	.2238	.2225	.2533	.2069	.6306	.5522	.3105	.1925	.2093	.3879	.4950	.2678	.2856
Plant arbitrary.....	.4670	.3126	.3960	.3960	.3960	.3960	.4360	.4360	.4360	.4360	.4360	.4360	.4200
Division expense.....	.0918	.1392	.1560	.1280	.1570	.1426	.0743	.0474	.0703	.1537	.2307	.2324	.1084
Total division cost.....	5,8990	7,3666	7,3936	7,5902	8,8428	7,6237	6,8535	6,3754	6,4343	7,4964	8,9027	8,0814	7,0133
Administrative and general expense.....	.3067	.5286	.5214	.4606	1.0174	.6366	.3106	.2056	.2459	.4509	.8722	.6378	.4105
Total cost.....	6,2057	7,8952	7,9150	8,0508	9,8602	8,2603	7,1641	6,5810	6,6802	7,9473	9,7749	8,7192	7,4238
Masonry, reenforced.....cubic yards..				168	189	179	82						618
Cement.....				\$1.6964	\$1.7778	\$1.7606	\$1.7305						\$1.7444
Stone.....				1.8627	1.7425	2.0417	2.0104						1.8974
Sand.....				.8300	.8266	.9292	1.0513						.8871
Mixing.....				.3601	.5010	.3293	.1967						.3726

[illegible]

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 4.—*Masonry*—Continued.

ATLANTIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN LOCKS—continued.													
Masonry, reinforced.....cubic yards..	1, 477	3, 180	4, 014	6, 489	4, 885	6, 715	6, 177	5, 593	6, 655	6, 119	4, 000	4, 579	59, 883
Cement.....	\$2. 2830	\$2. 2500	\$2. 2040	\$1. 9871	\$2. 3520	\$2. 2997	\$2. 5355	\$2. 5112	\$2. 4360	\$1. 8165	\$1. 8703	\$1. 8992	\$2. 2111
Stone.....	1. 9997	2. 3353	1. 9788	2. 3917	1. 9323	1. 8375	2. 0825	2. 0163	1. 8000	1. 8725	1. 6956	2. 0450	1. 9930
Sand.....	. 7548	1. 0054	. 9010	. 2419	1. 0040	1. 2976	1. 2602	1. 0926	. 9466	. 8781	. 7670	. 8574	1. 0381
Mixing.....	1. 5547	1. 1060	. 5568	. 5848	. 6030	. 4849	. 4323	. 5765	. 3324	. 4245	. 8002	. 6789	. 5855
Wood forms.....	5. 0664	3. 5433	4. 1322	2. 6324	3. 5058	1. 9447	2. 6004	2. 7015	2. 5011	2. 4656	3. 1006	2. 5335	2. 8307
Steel forms.....	. 5233	. 2012	. 2005	. 2510	. 1549	. 0951	. 1307	. 0259	. 0766	. 0770	. 1156	. 0066	. 1281
Power.....							. 1307	. 0259	. 0766	. 0770	. 1156	. 0066	. 1281
Placings.....	. 7727	. 7264	. 6528	. 5180	. 4359	. 5193	. 6011	. 7362	. 7985	. 9164	1. 3738	1. 0756	. 7385
Reinforcements.....	1. 9732	. 6520	1. 3569	1. 3915	. 7938	. 8602	. 6677	. 4392	1. 0587	. 2864	. 7900	. 8694	. 8623
Pumps.....			. 0209										. 0014
Maintenance of equipment.....	. 0942	. 0716	. 2221	. 2249	. 0296	. 2162	. 1857	. 1358	. 1538	. 2139	. 4629	. 3871	. 2033
Plant arbitrary.....	. 7110	. 9855	. 8800	. 8800	. 8800	. 9670	. 9670	. 9670	. 9672	. 9670	. 9670	. 9670	. 9281
Division expense.....	. 4879	. 3864	. 3258	. 2614	. 2298	. 1750	. 2466	. 2078	. 2233	. 2454	. 3451	. 4111	. 2703
Total division cost.....	16. 2199	13. 2361	13. 4318	12. 3647	11. 9211	10. 6600	11. 7299	11. 4476	11. 3246	10. 2762	12. 3340	11. 7728	11. 8228
Administrative and general expense.....	1. 7526	1. 1013	1. 1841	. 6067	. 9685	. 6339	. 7245	. 7719	. 7110	. 6543	1. 0761	. 9542	. 8367
Total cost.....	17. 9725	14. 3374	14. 6159	12. 9714	12. 8896	11. 3139	12. 4544	12. 2195	12. 0356	10. 9305	13. 4101	12. 7270	12. 6595
Total masonry.....cubic yards..	71, 046	66, 928	57, 298	53, 636	43, 907	43, 590	34, 983	26, 664	27, 532	11, 600	7, 506	5, 804	450, 494
Total cost.....	\$6. 6643	\$7. 6876	\$7. 6217	\$7. 9333	\$8. 3043	\$8. 3392	\$9. 0551	\$9. 4721	\$8. 8108	\$10. 4912	\$12. 2198	\$13. 8802	\$8. 0956

PACIFIC DIVISION.

PEDRO MIGUEL LOCKS.													
Concrete.....cubic yards..	16, 410	19, 708	14, 740	24, 161	18, 008	9, 107	8, 810	8, 597	4, 145	3, 906	3, 180	3, 421	134, 193
Cement.....	\$1. 7184	\$1. 7491	\$1. 8285	\$1. 6519	\$1. 5531	\$1. 8229	\$0. 9951	\$2. 3503	\$0. 8311	\$1. 6455	\$1. 3547	\$1. 4678	\$1. 6564
Stone.....	. 7905	. 7719	. 7626	. 7533	. 7626	. 7533	. 7700	. 7905	. 6850	. 7348	. 7067	. 7255	. 7619
Sand.....	. 3995	. 3995	. 3948	. 3854	. 3995	. 3948	. 3658	. 3525	. 3254	. 3290	. 3103	. 3149	. 3823
Mixing.....	. 3215	. 3378	. 3285	. 3388	. 3216	. 4191	. 3837	. 4003	. 4350	. 4019	. 4508	. 4689	. 3562
Total cost.....	3. 2299	3. 2583	3. 3144	3. 1294	3. 0368	3. 3901	2. 5146	3. 8936	2. 2765	3. 1112	2. 8225	2. 9771	3. 1568
Masonry.....cubic yards..	16, 410	19, 708	14, 740	24, 161	18, 008	9, 107	8, 810	8, 597	4, 145	3, 906	3, 180	3, 421	134, 193
Concrete.....	\$3. 2299	\$3. 2583	\$3. 3144	\$3. 1294	\$3. 0368	\$3. 3901	\$2. 5146	\$3. 8936	\$2. 2765	\$3. 1112	\$2. 8225	\$2. 9771	\$3. 1568

Wood forms.....	.5399	.7801	.5424	1. 0155	.7149	.8293	1. 0992	1. 7447	.4064	1. 1078	1. 1993	.7596
Steel forms.....	.0057	.0136	.0087	.....	.0010	.0001	.....	.....	.....	.....	.....	.0041
Placing.....	.5688	.5890	.3122	.4589	.7537	.5863	.6093	.9535	.8916	1. 0695	1. 0494	.5619
Reinforcements.....	.0597	.....	.....	.0011	.....	.....	.....	.....	.....	.....	.....	.0074
Pumps.....	.0293	.0405	.0513	.0432	.0378	.0293	.0152	.0161	.0090	.0182	.0146	.0331
Power.....	.0444	.0259	.0104	.0146	.0146	.0081	.0121	.0154	.0075	.0179	.0132	.0199
Maintenance of equipment.....	.1962	.1843	.1045	.1098	.2055	.1630	.0932	.1636	.1612	.1660	.1511	.1511
Plant arbitrary.....	1. 0228	1. 0189	1. 0107	1. 0133	1. 0127	.5689	.5697	.5715	.5709	.5800	.5791	.9101
Division expense.....	.1238	.1099	.0893	.1029	.1373	.1173	.1152	.1389	.1479	.1594	.1741	.1143
Total division cost.....	5. 8205	5. 6346	5. 2589	5. 7961	6. 2676	4. 8169	6. 4075	5. 8802	5. 3057	5. 9413	6. 1975	5. 7183
Administrative and general expense.....	.3362	.2548	.2425	.3544	.2509	.2527	.3710	.4363	.3533	.4684	.5022	.3085
Total cost.....	\$6.1567	\$5.8894	\$5.5014	\$6.1505	\$6.5185	\$5.0696	\$6.7785	\$6.3165	\$5.6590	\$6.4097	\$6.6997	\$6.0268
Masonry, reinforced.....cubic yards..	- 3. 496	1. 028	1. 476	1. 614	5. 253	6. 193	4. 042	5. 186	5. 554	7. 556	6. 640	48. 677
Cement.....	\$2. 4104	\$2. 3802	\$2. 4316	\$2. 1901	\$2. 6154	\$2. 3712	\$2. 6048	\$2. 1305	\$2. 2678	\$1. 9275	\$2. 0976	\$2. 2715
Stone.....	.7564	.7380	.7211	.7296	.7209	.7387	.7566	.6876	.7032	.6764	.6941	.7133
Sand.....	.3739	.3737	.3611	.3739	.3695	.3432	.3299	.3168	.3080	.3048	.3148	.3282
Mixing.....	.1801	.5246	.2026	.2676	.2752	.3527	.4235	.5092	.4503	.4682	.5711	.4112
Wood forms.....	.5849	4. 1201	1. 8758	1. 9198	1. 2330	1. 5293	2. 3210	2. 2290	2. 2127	1. 5369	1. 4906	1. 6959
Power.....	.0011	.0015	.0056	.0322	.0163	.0095	.0073	.0076	.0066	.0024	.0010	.0085
Placing.....	.1291	.0719	.0716	.7779	.5139	.6572	.8152	.8995	1. 0705	.7532	.6846	.7087
Reinforcements.....	.6803	1. 8411	.9601	2. 1268	1. 8099	1. 4437	1. 9276	1. 2898	1. 3660	.9671	1. 0102	1. 3263
Pumps.....	.....	.0294	.0405	.0431	.0378	.0293	.0152	.0161	.0090	.0124	.0146	.0197
Maintenance of equipment.....	.....	.0633	.1016	.1933	.1834	.1850	.1065	.1362	.1222	.0668	.1004	.1198
Plant arbitrary.....	1. 0228	1. 0006	1. 0442	1. 0271	1. 0141	.5703	.5697	.5699	.5680	.5623	.5615	.6923
Division expense.....	.1166	.2382	.2864	.2535	.1914	.2073	.2673	.2160	.2586	.2118	.2511	.2241
Total division cost.....	6. 2556	8. 7383	8. 8580	9. 9412	8. 9808	8. 4374	10. 1446	9. 0082	9. 3429	7. 4754	7. 7716	8. 5195
Administrative and general expense.....	.3875	.5171	.6212	.7454	.5077	.5938	.7611	.7976	.7462	.6056	.6811	.6443
Total cost.....	6. 6431	9. 2554	9. 4742	10. 6866	9. 4885	9. 0312	10. 9057	9. 8058	10. 0891	8. 0810	8. 4527	9. 1638
Total masonry.....cubic yards..	19. 906	20. 736	25. 637	19. 622	14. 360	15. 003	12. 639	9. 331	9. 460	10. 736	10. 061	182. 870
Total cost.....	\$6. 2421	\$6. 0563	\$5. 7301	\$6. 5237	\$7. 6050	\$6. 7049	\$8. 0984	\$8. 2558	\$8. 2600	\$7. 5860	\$6. 8566	\$6. 8618
MIRAFLORES LOCKS.												
Concrete.....cubic yards..	32. 840	56. 890	60. 420	41. 427	48. 122	47. 309	62. 207	80. 314	93. 476	87. 014	63. 178	729. 096
Cement.....	\$1. 8287	\$1. 7500	\$1. 7104	\$1. 6721	\$2. 1117	\$1. 8031	\$2. 1629	\$1. 7566	\$1. 8811	\$1. 5526	\$1. 6860	\$1. 7920
Stone.....	.7905	.7719	.7399	.7626	.7533	.7719	.7905	.7161	.7347	.7068	.7246	.7464
Sand.....	.3995	.3995	.3854	.3995	.3948	.3666	.3525	.3384	.3290	.3102	.2986	.3564
Mixing.....	.2984	.1850	.2168	.2997	.2696	.2443	.1877	.2420	.2037	.2126	.2333	.2258
Total cost.....	3. 3171	3. 1064	3. 0399	3. 1339	3. 5294	3. 1859	3. 4936	3. 0531	3. 1485	2. 7822	2. 9425	3. 1206

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 4.—Masonry—Continued.

PACIFIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
MIRAFLORES LOCKS—continued.													
Masonry.....cubic yards..	32,840	56,890	55,899	60,420	41,427	48,122	47,309	62,207	80,314	93,476	87,014	63,178	729,096
Concrete.....	\$3.3171	\$3.1064	\$3.0399	\$3.0525	\$3.1339	\$3.5294	\$3.1859	\$3.4936	\$3.0531	\$3.1485	\$2.7822	\$2.9425	\$3.1206
Wood forms.....	.4354	.3098	.3351	.4923	.5482	.4267	.4992	.3659	.3292	.3597	.3171	.5718	.4030
Steel forms.....	.0413	.0360	.0105	.0339	.0321	.0461	.0321	.0558	.0491	.0366	.0254	.0364	.0364
Placing.....	.1923	.1695	.1420	.1629	.2491	.2049	.2081	.1853	.2109	.2253	.2100	.2412	.2014
Reinforcements.....	.0262												.0012
Pumps.....	.0175	.0175	.0383	.0229	.0210	.0251	.0150	.0446	.0390	.0331	.0309	.0403	.0327
Power.....	.0468	.0366	.0234	.0238	.0314	.0279	.0440	.0337	.0292	.0210	.0220	.0263	.0289
Maintenance of equipment.....	.2163	.1780	.1295	.1388	.1871	.2025	.1871	.1248	.1359	.1125	.1272	.1631	.1545
Plant arbitrary.....	.5310	.5305	.5304	.5300	.5300	.5300	.5500	.5500	.5500	.5500	.5500	.5500	.5420
Division expense.....	.0916	.0631	.0326	.0679	.0855	.0772	.0730	.0551	.0508	.0611	.0625	.0810	.0660
Total division cost.....	4.9328	4.4527	4.3272	4.5016	4.8900	5.0558	4.8084	4.9088	4.4472	4.5478	4.1473	4.6394	4.5867
Administrative and general expense.....	.2931	.1900	.1913	.2069	.3037	.2427	.2329	.2076	.2101	.2120	.2022	.2717	.2240
Total cost.....	5.2259	4.6427	4.5185	4.7085	5.1937	5.2985	5.0413	5.1164	4.6573	4.7598	4.3495	4.9111	4.8107
Masonry, reinforced.....cubic yards..		113	184	453	299	650	1,107	1,686	3,392	4,259	5,081	5,220	22,444
Cement.....		\$3.0512	\$2.9997	\$2.5850	\$2.6048	\$2.9564	\$1.9440	\$3.0088	\$1.2273	\$2.1804	\$1.7813	\$2.0347	\$2.0051
Stone.....		.7419	1.7247	1.2028	.9297	.7215	.7393	.7562	.6853	.7032	.6766	.6942	.7222
Sand.....		.3761	.9176	.6860	.5430	.3696	.3431	.3302	.3167	.3080	.2904	.2948	.3236
Mixing.....		.1536	6.0970	.9946	3.8153	1.8119	.7396	.5094	.6843	.7210	.7106	.8041	.8380
Wood forms.....		5.4028	5.6962	4.0585	3.6764	2.0893	3.0937	2.3060	.8874	1.3610	2.6787	2.8876	2.2615
Steel forms.....			1.4396	7.0239	3.3165	.8433	.5115	2.2333	.8845	.5860	.2113	.0249	.7138
Power.....			.0528		.0228	.0045	.0060	.0160	.0108	.0065	.0057	.0063	.0080
Placing.....		.1887	2.2907	1.6304	2.4981	1.4725	1.0469	1.0326	.4005	.5335	.9233	1.0699	.8883
Reinforcements.....			2.8124	1.2129	4.6992	2.7722	.5125	1.9326	1.6228	1.1848	2.2754	1.9504	1.7997
Pumps.....		.0174	8.7614	.4359	.0211	.1192	.0010	.0449	.0390	.1007	.0154	.1257	.1257
Maintenance of equipment.....		.1904	.0735	.1748	.2477	.1994	.0488	.0759	.0756	.0862	.0805	.1066	.0931
Plant arbitrary.....		.5300	.5563	.5300	.5300	.5300	.5500	.5500	.5499	.5500	.5500	.5500	.5487
Division expense.....		.5144	1.1622	.7607	.8524	.5520	.3391	.2910	.1614	.2060	.2898	.3808	.3111
Total division cost.....		11.1665	34.5841	21.3855	23.7570	14.4468	9.7955	13.1069	7.5455	8.5773	10.4890	10.8446	10.6388
Administrative and general expense.....		.8459	2.6378	1.7643	2.2688	1.1558	.7701	.8724	.5124	.5664	.8096	.9473	.8172
Total cost.....		12.0124	37.2219	23.1498	26.0258	15.6026	10.5656	13.9793	8.0579	9.1437	11.2986	11.7919	11.4560
Total masonry.....cubic yards	32,840	57,003	56,083	60,873	41,726	48,772	48,416	63,893	83,706	97,735	92,095	68,398	751,540
Total cost.....	\$5.2259	\$4.6573	\$4.6258	\$4.8458	\$5.3430	\$5.4358	\$5.1677	\$5.3503	\$4.7951	\$4.9509	\$4.7328	\$5.4362	\$5.0091

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 5.—Dry filling.
ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN DAM.													
Dry fill.....cubic yards..	201.996	232,426	194,497	218,305	207,157	233,063	239,266	145,221	229,059	286,956	227,017	193,110	2,608,073
Clearing site.....	\$0.0003	\$0.0046	\$0.0010	\$0.0004	\$0.0008	\$0.0736	\$0.0534	\$0.2241	\$0.1762	\$0.0003	\$0.0012	\$0.0698	\$0.0007
Excavation.....	.0041	.0017	.0196	.0297	.0372	.0754	.0686	.1337	.1075	.1137	.0759	.1215	.0724
Tracks.....	.0571	.0682	.0881	.0840	.0850	.0754	.0686	.1337	.1075	.1137	.0759	.1215	.0724
Trestles.....	.0039	.0057	.0007	.0066	.0161	.0036	.0037	.0042	.0022	.0004	.0006	1.0004	.0038
Transportation.....	.1513	.1276	.1562	.1378	.1301	.1189	.2038	.1393	.0741	.0737	.0774	.0787	.1209
Filling.....	.1284	.1285	.1290	.1325	.1307	.1290	.1079	.1012	.0643	.0597	.0658	.1010	.1209
Maintenance of equipment.....	.0281	.0313	.0384	.0384	.0468	.0246	.0400	.0914	.0661	.0394	.0547	.0685	.0457
Plant arbitrary.....	.1017	.0364	.0709	.0819	.0885	.0872	.0262	.0539	.0710	.0710	.0710	.0710	.0690
Division expense.....	.0178	.0198	.0194	.0173	.0168	.0144	.0145	.0213	.0188	.0156	.0207	.0319	.0187
Total division cost.....	.4927	.4238	.5233	.5286	.5520	.5267	.5181	.7691	.5802	.4546	.4573	.4879	.5174
Administrative and general expense.....	.0283	.0346	.0341	.0304	.0451	.0377	.0252	.0484	.0448	.0347	.0356	.0362	.0359
Total cost.....	.5210	.4584	.5574	.5590	.5971	.5644	.5433	.8175	.6250	.4893	.4929	.5241	.5533
GATUN SPILLWAY.													
Back filling.....cubic yards..	770		5,712		2,951	629							10,062
Loading.....													
Tracks.....	\$0.0499												\$0.0038
Transportation.....	.2488		\$0.1152			\$0.3987							.2220
Filling.....	.0977		.0622			.0359							.0482
Maintenance of equipment.....	.0400		.0548		\$0.1460								.0739
Plant arbitrary.....			.0117			.0189							.0109
Division expense.....	.0307		.0177		.0088	.0287							.0055
Total division cost.....	.4671		.2616		.1548	.6197							.3898
Administrative and general expense.....	.0497		.0259		.0204	.0704							.0438
Total cost.....	.5168		.2875		.1752	.6901							.4336

1 Denotes credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 5.—*Dry filling*—Continued.

ATLANTIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN LOCKS.													
Dry fill—approach wall.....cubic yards.							7, 072						7, 072
Filling.....							\$0. 2884						\$0. 2884
Tracks.....							.0799						.0799
Maintenance of equipment.....							.0652						.0652
Plant arbitrary.....							.0600						.0600
Division expense.....							.0157						.0157
Total division cost.....							.5092						.5092
Administrative and general expense.....							.0250						.0250
Total cost.....							.5342						.5342
Back filling.....cubic yards.													
Drilling.....	62, 641	78, 650	108, 068	105, 611	95, 006	92, 043	68, 663	51, 229	61, 035	51, 555	66, 579	81, 085	922, 215
Blasting.....		\$0. 0047	\$0. 0036	\$0. 0078	\$0. 0204	\$0. 0198	\$0. 0232	\$0. 0225	\$0. 0154	\$0. 0198	\$0. 0417	\$0. 0151	\$0. 0152
Loading.....		.0165	.0068	.0218	.0296	.0271	.0202	.0432	.0289	.0267	.0266	.0399	.0239
Tracks.....		.0196	.0100	.0106	.0159	.0144	.0243	.0343	.0362	.0430	.0332	.0482	.0239
Transportation.....		.1358	.0889	.0833	.1812	.0566	.0588	.0483	.0343	.0682	.1797	.1382	.1031
Filling.....		.0361	.0382	.0284	.0557	.0372	.0750	.0879	.0639	.0748	.1376	.2004	.0695
Maintenance of equipment.....		.1451	.0652	.1286	.0750	.1505	.0810	.1416	.1512	.0808	.0926	.0886	.1068
Plant arbitrary.....		.0834	.0234	.0277	.0329	.0452	.0484	.0515	.0359	.0433	.0497	.0524	.0408
Division expense.....		.0254	.0203	.0504	.0902	.0965	.0510	.0684	.0551	.0600	.0600	.0600	.0576
Total cost.....		.0240	.0165	.0178	.0185	.0172	.0152	.0177	.0191	.0177	.0263	.0337	.0207
Total division cost.....		.4726	.2729	.3764	.5194	.4545	.4031	.5154	.4420	.4393	.6474	.6765	.4615
Administrative and general expense.....		.0509	.0250	.0304	.0478	.0450	.0301	.0458	.0342	.0334	.0545	.0480	.0399
Total cost.....		.5235	.2979	.4068	.5672	.4995	.4332	.5612	.4762	.4727	.7019	.7245	.5014
Filling center wall.....cubic yards.													
Loading.....	400	200	6, 191	9, 129	470	23, 058	6, 892	18, 775	4, 672	12, 982	6, 474	5, 331	94, 574
Tracks.....							\$0. 1184	\$0. 1000	\$0. 0904	\$0. 0820	\$0. 1225	\$0. 1037	\$0. 0584
Transportation.....							.1150	.0483	.0461	.0412	.1770	.1395	.0476
Filling.....							.1777	.0599	.2165	.1211	.1944	.2578	.0896
Power.....							.3315	.0540	.0890	.0888	.1538	.1256	.1884
Maintenance of equipment.....							.0631	.0750	.0911	.0352	.1291	.1643	.0749

[illegible]

PACIFIC DIVISION.

PEDRO MIGUEL DAM.													
Dry fill.....cubic yards.	14,865	24,812	4,052	3,400	3,190	7,350	33,044	35,153	86,252	67,385	21,782	15,304	321,589
Tracks.....	\$0.0599	\$0.0288	\$0.5082	\$0.1044	\$0.0797	\$0.0907	\$0.0369	\$0.0988	\$0.0309	\$0.0308	\$0.0812	\$0.1594	\$0.0583
Trestles.....		.0003											
Transportation.....		.0349	.1172	.0246	.0150	.0198	.0193	.0262	.0273	.0252	.0504	.0865	.0303
Filling.....	.0161	.0272	.1804	.0878	.0408	.0531	.0344	.3952	.1537	.0384	.1080	.1868	.1204
Maintenance of equipment.....	.0503	.0150	.0649	.0229	.0176	.0487	.0229	.0201	.0149	.0212	.0509	.0703	.0260
Plant arbitrary.....	.1300	.1300	.1300	.1300	.1300	.1300	.2900	.2900	.2900	.2900	.2900	.2900	.2613
Division expense.....	.0039	.0048	.0502	.0154	.0086	.0102	.0052	.0053	.0043	.0053	.0121	.0237	.0077
Total division cost.....	.2602	.2410	1.0509	.3851	.2917	.3525	.4097	.8388	.5211	.4114	.5926	.8167	.5040
Administrative and general expense.....	.0075	.0089	.0918	.0278	.0172	.0149	.0076	.0136	.0083	.0086	.0234	.0372	.0128
Total cost.....	.2677	.2499	1.1427	.4129	.3089	.3674	.4173	.8524	.5294	.4200	.6160	.8539	.5168
PEDRO MIGUEL LOCKS.													
Back filling.....cubic yards.	13,707	18,786	22,974	52,263	31,765	28,887	29,312	33,175	18,207	33,822	43,440	22,937	349,275
Tracks.....	\$0.1749	\$0.0835	\$0.1138	\$0.0725	\$0.0955	\$0.0447	\$0.0559	\$0.0538	\$0.0072	\$0.0061	\$0.0378	\$0.0953	\$0.0638
Transportation.....	.1224	.0700	.0587	.0084	.0301	.0409	.0304	.0239	.0442	.0254	.0367	.0620	.0381
Filling.....	.2112	.1587	.1509	.1792	.0482	.0484	.0860	.0566	.1446	.0928	.1010	.0869	.1094
Maintenance of equipment.....	.0472	.0327	.0346	.0123	.0276	.0304	.0222	.0163	.0242	.0424	.0571	.0306	.0306
Plant arbitrary.....	.1100	.1100	.1100	.1100	.1100	.1100	.0900	.0900	.0900	.0900	.0900	.0900	.0996
Division expense.....	.0376	.0230	.0192	.0112	.0105	.0083	.0114	.0078	.0093	.0052	.0088	.0147	.0120
Total division cost.....	.7033	.4779	.4872	.3936	.3383	.2799	.3041	.2484	.3175	.2437	.3167	.4060	.3535
Administrative and general expense.....	.0571	.0318	.0358	.0201	.0217	.0121	.0206	.0172	.0236	.0107	.0222	.0313	.0227
Total cost.....	.7604	.5097	.5230	.4137	.3600	.2920	.3247	.2656	.3411	.2544	.3389	.4373	.3762

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 5.—*Dry filling—Continued.*

PACIFIC DIVISION—Continued.

[illegible]

Plant arbitrary																		.1200	.1200	.1200	.1200
Division expense.....																		.1052	.1052	.0266	.0266
Total division cost.....																		1.6776	.9609	1.0126	.9609
Administrative and general expense.....																		.2034	.0391	.0509	.0509
Total cost.....																		1.8810	1.0000	1.0635	1.0635
MIRAFLORES DAM.																					
Dry fill.....cubic yards..	54,415	72,203	34,480	37,250	31,800	23,730	24,920	26,475	24,570	26,292	31,220	37,770	425,125								
Tracks.....	\$0.0308	\$0.0181	\$0.0691	\$0.0955	\$0.0956	\$0.1074	\$0.1220	\$0.0988	\$0.1037	\$0.0902	\$0.1696	\$0.0606	\$0.0768								
Transportation.....	.0632	.0461	.1041	.0830	.0803	.0674	.0528	.0569	.0480	.0486	.0560	.0560	.0629								
Filling.....	.0678	.0564	.0940	.0254	.0435	.0646	.0651	.1661	.0777	.0902	.0699	.0424	.0681								
Maintenance of equipment.....	.0216	.0213	.0594	.0480	.0774	.0445	.0486	.0336	.0296	.0433	.0580	.0483	.0416								
Plant arbitrary.....	.1800	.1800	.1800	.1800	.1800	.1800	.0900	.0900	.0900	.0900	.0900	.0900	.1437								
Division expense.....	.0110	.0080	.0127	.0109	.0104	.0137	.0153	.0109	.0115	.0135	.0137	.0102	.0113								
Total division cost.....	.3744	.3299	.5193	.4428	.4872	.4776	.3938	.4563	.3605	.3758	.4572	.3075	.4044								
Administrative and general expense.....	.0172	.0116	.0263	.0218	.0247	.0212	.0201	.0181	.0203	.0193	.0278	.0166	.0195								
Total cost.....	.3916	.3415	.5456	.4646	.5119	.4988	.4139	.4744	.3808	.3951	.4850	.3241	.4239								

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 6.—*Hydraulic filling.*

ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN DAM.													
Hydraulic fill.....cubic yards..	324,947	259,389	261,838	214,320	206,603	89,752	173,900	211,399	242,874	204,189	194,733	160,688	2,604,632
Clearing site.....	\$0.0003	\$0.0046	\$0.0010	\$0.0004	\$0.0008	\$0.0296	\$0.0235	\$0.0118	\$0.0047	\$0.0003	\$0.0083	\$0.0104	\$0.0007
Clearing for dredge.....	.0080	.0138	.0164	.0163	.0081	.3159	.1740	.1065	.0963	.1104	.1031	.1011	.0117
Dredging.....	.1044	.1215	.1052	.1650	.1212	.0354	.0143	.0090	.0142	.0168	.0132	.0153	.1244
Relay pumps.....	.0111	.0140	.0130	.0053	.0124	.0604	.0191	.0198	.0157	.0137	.0100	.0143	.0132
Pipe lines.....	.0328	.0450	.0346	.0268	.0224	.0037	.0046	.0023	.0009	.0009	.0016	.0028	.0257
Wood flumes.....	.0043	.0053	.0036	.0033	.0013	.0037	.0046	.0023	.0009	.0009	.0016	.0028	.0028
Power.....	.0613	.0828	.0675	.1128	.0573	.1643	.1066	.0479	.0051	.0860	.0736	.0554	.0762
Small boats.....	.0018	.0025	.0021	.0020	.0018	.0103	.0033	.0026	.0026	.0039	.0035	.0024	.0028
Maintenance of equipment.....	.0354	.0267	.0201	.0628	.0625	.1443	.0596	.0376	.0252	.0554	.0331	.0805	.0469
Plant arbitrary.....	.0500	.0770	.0620	.0620	.0620	.0620	.0850	.0850	.0850	.0850	.0850	.0850	.0725
Division expense.....	.0063	.0088	.0071	.0083	.0062	.0170	.0089	.0048	.0054	.0068	.0070	.0119	.0075
Total division cost.....	.3157	.4020	.3326	.4650	.3560	.8429	.4989	.3273	.3151	.3827	.3384	.3779	.3844
Administrative and general expense.....	.0185	.0243	.0206	.0164	.0223	.0540	.0253	.0173	.0115	.0145	.0166	.0206	.0201
Total cost.....	.3342	.4263	.3532	.4814	.3783	.8969	.5242	.3446	.3266	.3972	.3550	.3985	.4045
GATUN LOCKS.													
Hydraulic fill, approach wall..cubic yards..							48,408	141,230	139,015	162,457	103,385		594,495
Operation dredges.....							\$0.1248	\$0.0584	\$0.0536	\$0.0482	\$0.0745		\$0.0627
Repairs to dredges.....							.0165	.0039	.0072	.0051	.0048		.0062
Pipe lines.....								.0037		.0057	.0067		.0036
Plant arbitrary.....							.0218	.0850	.0819	.0850	.0850		.0799
Division expenses.....							.0018	.0019	.0011	.0020	.0032		.0021
Total division cost.....							.1649	.1529	.1438	.1460	.1742		.1545
Administrative and general expense.....							.0029	.0041	.0020	.0030	.0055		.0038
Total cost.....							.1678	.1570	.1458	.1490	.1797		.1583

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.
TABLE 7.—*Piles for foundations.*

ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN LOCKS.													
Preparing foundations, concrete piling, linear feet.....	8,244	2,700	10,560	3,990	26,895	17,055		1,215	4,815				75,474
Concrete piles in place.....	\$1.9440	\$1.8991	\$1.5512	\$1.5130	\$1.3181	\$1.4260		\$1.6414	\$1.4602				\$1.4849
Maintenance of equipment.....	.0409	.0053	.0148	.0020	.0004	.0010		.0144	.0102				.0078
Division expense.....	.0220	.0155	.0225	.0141	.0051	.0060		.0108	.0096				.0105
Total division cost.....	2.0069	1.9199	1.5885	1.5291	1.3236	1.4330		1.6666	1.4800				1.5082
Administrative and general expense.....	.0481	.2549	.0390	.0291	.0150	.0188		.0350	.0162				.0320
Total cost.....	2.0550	2.1748	1.6275	1.5582	1.3386	1.4518		1.7016	1.4962				1.5352
Preparing foundations, wooden piling, linear feet.....		8,845	12,900	15,425	14,280								51,450
Wooden piles in place.....		\$0.7339	\$0.7462	\$0.6167	\$0.5256								\$0.6440
Maintenance of equipment.....		.0016	.0075	.0005	.0002								.0024
Division expense.....		.0097	.0050	.0051	.0027								.0052
Total division cost.....		.7452	.7587	.6223	.5285								.6516
Administrative and general expense.....		.0654	.1441	.0299	.1013								.0845
Total cost.....		.8106	.9028	.6522	.6298								.7361

PACIFIC DIVISION.

MIRAFLORES LOCKS.													
Preparing foundations, wooden piling, linear feet.....											1,995	4,585	6,580
Wooden piles in place.....											\$0.1681	\$0.2912	\$7.5527
Division expense.....											.0110	.0103	.0863
Total division cost.....											.1791	.3015	7.6390
Administrative and general expense.....											.0222	.0296	.5444
Total cost.....											.2013	.3311	8.1834

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 8.—Breakwaters.
ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
COLON BREAKWATER.													
Toro Point fill:													
Excavation.....cubic yards..	46,179	44,958	33,813	21,815	17,249	46,591	48,423	42,927	48,401	46,583	44,009	19,692	460,040
Surveys.....				\$0.0013	\$0.0012						\$0.0001		\$0.0001
Drilling.....	\$0.0221	\$0.0204	\$0.0058			\$0.0116	\$0.0097	\$0.0132	\$0.0072	\$0.0328	.0289	\$0.0431	.0167
Blasting.....	.1647	.1481	.0625	.0110	.0334	.0327	.0330	.0538	.0541	.0899	.0736	.0499	.0731
Loading by power.....	.0631	.0933	.1339	.0890	.1119	.0778	.0749	.0693	.0902	.0750	.1000	.0682	.0854
Tracks.....	.0647	.0435	.0442	.0617	.0712	.0106	.0268	.0149	.0194	.0045	.0317	.0448	.0323
Transportation.....	.0940	.0898	.0944	.0733	.1058	.0724	.0784	.0828	.0610	.0622	.0638	.0961	.0787
Maintenance of equipment.....	.0765	.0725	.0364	.0678	.2474	1.0365	.0309	.0283	.0590	.0460	.0468	.0661	.0502
Total.....	.4851	.4676	.3772	.3041	.5709	.1686	.2537	.2623	.2909	.3104	.3447	.3682	.3365
Filling.....cubic yards..	46,179	44,958	33,813	21,815	17,249	46,591	48,423	42,927	48,401	46,583	44,009	19,092	460,040
Trestles.....	\$1.1696	\$0.9154	\$0.6741	\$0.5275	\$1.0023	\$0.5150	\$0.3130	\$0.5160	\$0.4366	\$0.3594	\$0.4349	\$0.2618	\$0.6095
Dumping.....	.0082	.0084	.0119	.0187	.0137	.0140	.0107	.0106	.0090	.0068	.0068	.0063	.0100
Maintenance of equipment.....	.0220	.0066	.0175	.0291	.0142	.0395	.0109	.0060	.0047	.0074	.0080	.0100	.0142
Total.....	1.1998	.9304	.7035	.5753	1.6302	.5685	.3346	.5326	.4503	.3736	.4497	.2781	.6337
Plant arbitrary.....	.1690	.4548	.3100	.3100	.3100	.3100	.2960	.2960	.2960	.2960	.2960	.2960	.3024
Division expense.....	.0349	.0381	.0388	.0392	.0458	.0202	.0210	.0175	.0187	.0230	.0273	.0496	.0284
Tug service.....	.0663	.0844	.0793	.1076	.2050	.0653	.0798	.0821	.0648	.0639	.0828	.1148	.0822
Total division cost.....	1.9542	1.9753	1.5088	1.3362	2.7619	1.1326	.9851	1.1905	1.1207	1.0669	1.2005	1.1067	1.3832
Administrative and general expense.....	.1398	.2446	.1642	.0734	.3947	.1046	.0915	.1094	.0785	.0908	.0994	.1011	.1299
Total cost filling.....	2.0940	2.2199	1.6730	1.4096	3.1566	1.2372	1.0766	1.2999	1.1992	1.1577	1.2999	1.2078	1.5131
Porto Bello large rock:													
Quarrying.....cubic yards..		506	2,822	3,484	4,117	6,179	7,287	8,393	9,068	8,380	7,532	7,365	65,133
Stripping.....		\$0.1034	\$0.0016	\$0.1182	\$0.0849	\$0.6543	\$0.3944	\$0.3765	\$0.1674	\$0.2666	\$0.7948	\$1.0290	\$0.4331
Drilling.....		1.1407	.4178	.3824	.1893	.1762	.1329	.0946	.1752	.1907	.2614	.2614	.2119
Blasting.....		.5438	.9227	.4772	.3929	.3033	.3033	.2403	.2628	.2715	.2492	.3152	.3152
Loading.....		.9001	.3021	.3273	.2095	.1889	.2626	.3396	.3917	.3784	.2320	.2421	.2993

Transportation.....	.2041	.2337	.2848	.2539	.1759	.2252	.1756	.2301	.2416	.1802	.1630	.2099
Tracks.....	1.1411	.2277	.3839	.3898	.1618	.2147	.2183	.2250	.1618	.2484	.2674	.2603
Loading on barges.....	.0336	.1486	.1620	.1438	.1288	.1439	.1262	.1351	.1620	.0955	.1299	.1344
Power.....	.7305	.1430	.1039	.0842	.0569	.0464	.0399	.0360	.0409	.1877	.2466	.0980
Maintenance of equipment.....	.9228	.6375	.8570	.6924	.4634	.3163	.3174	.4000	.3872	.7373	.6055	.5039
Plant arbitrary.....	.2690	.2690	.2690	.2690	.2690	.2340	.2340	.2340	.2340	.2340	.2340	.2432
Total.....	5.9891	3.3037	3.3657	2.7097	2.7586	2.2737	2.1624	2.1973	2.3347	3.2205	3.4918	2.7992
Towing.....cubic yards..	506	2,822	3,484	4,117	6,179	7,287	8,393	9,068	8,380	7,532	7,365	65,133
Operation, tugs and barges.....	\$0.7817	\$0.2690	\$0.2364	\$0.2657	\$0.4169	\$0.3094	\$0.2577	\$0.3054	\$0.2852	\$0.4750	\$0.5047	\$0.3461
Maintenance of equipment.....	.1631	.0298	.0330	.0834	.0452	.1612	.1225	.0482	.0425	.2674	.1059	.1096
Plant arbitrary.....	.4930	.4930	.4930	.4930	.4930	.4040	.4040	.4040	.4040	.4040	.4040	.4274
Total.....	1.4438	.7918	.7624	.8421	.9551	.8746	.7842	.7576	.7317	1.1494	1.0746	.8831
Placing.....cubic yards..	506	2,822	3,484	4,117	6,179	7,287	8,393	9,068	8,380	7,532	7,365	65,133
Operation of floating derricks.....	\$0.4647	\$0.2807	\$0.0130	\$0.1519	\$0.1038	\$0.1391	\$0.1437	\$0.1743	\$0.1851	\$0.0870	\$0.0688	\$0.0185
Operation, cranes.....	.4477	.1172	.0316	.0314	.0704	.0398	.0299	.0966	.1088	.1961	.2029	.1724
Operation, trams.....	.....	.....	.0097	.0483	.0163	.0014	.0317	.0163	.0176	.0331	.0242	.0785
Dumping.....	.....	.....	.0896	.0772	.0583	.0426	.0462	.1222	.1545	.2502	.1972	.0209
Maintenance of equipment.....	.0814	.0300	.1400	.1400	.1400	.1290	.1290	.1290	.1290	.1290	.1290	.1160
Plant arbitrary.....	.1400	.1400	.1400	.1400	.1400	.1290	.1290	.1290	.1290	.1290	.1290	.1319
Total.....	1.1308	.5679	.4598	.4488	.3893	.3519	.3835	.5384	.5950	.8175	.7081	.5382
Division expense.....	.4847	.1877	.1573	.1192	.1252	.1288	.1121	.1200	.1522	.2775	.3443	.1759
Total division cost.....	9.0484	4.8511	4.7452	4.1198	4.2282	3.6290	3.4422	3.6133	3.8136	5.4649	5.6188	4.3064
Administrative and general expense.....	1.2386	.4995	.2609	.2806	.3072	.2819	.2939	.2491	.2919	.5285	.3820	.3381
Total cost, large rock.....	10.2870	5.3506	5.0061	4.4004	4.5354	3.9109	3.7361	3.8624	4.1055	5.9934	6.0008	4.6445
Total material placed..cubic yards..	46,179	36,635	25,299	21,336	52,770	55,710	51,320	57,469	54,963	51,541	26,457	525,173
Total cost.....	\$2.0940	\$1.9290	\$1.9049	\$3.3963	\$1.6234	\$1.4473	\$1.6953	\$1.6194	\$1.6071	\$1.9858	\$2.5421	\$1.9014

1 Denotes credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 9.—Stone production.

ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
PORTO BELLO QUARRY.													
Quarrying.....cubic yards..	43,352	41,826	44,352	43,638	43,193	42,247	46,858	41,493	47,282	46,172			440,413
Stripping.....	\$0.0079	\$0.0216	\$0.0106	\$0.0228	\$0.0080	\$0.0161	\$0.0147	\$0.0212		\$0.0149			\$0.0040
Drilling.....	.0587	.0636	.0465	.0486	.0440	.0532	.0419	.0473	\$0.0267	.0027			.0431
Blasting.....	.1181	.2744	.2142	.1781	.1903	.1590	.1467	.1445	.0987	.1132			.1622
Loading.....	.1018	.0923	.0833	.0780	.0716	.0763	.0580	.0785	.0656	.0724			.0774
Transportation.....	.0814	.0851	.0793	.0738	.0644	.0705	.0504	.0618	.0537	.0518			.0669
Tracks.....	.0400	.0334	.0198	.0404	.0366	.0428	.0322	.0253	.0302	.0335			.0340
Power.....	.0274	.0398	.0409	.0374	.0362	.0375	.0326	.0365	.0311	.0335			.0353
Maintenance of equipment.....	.0417	.0799	.0756	.1402	.0304	.0803	.0604	.1086	1.0232	.0441			.0621
Plant arbitrary.....	.3300	.5072	.4170	.4170	.4170	.4170	.6622	.6660	.6660	.6660			.4897
Total.....	.8070	1.1973	.9872	1.0363	.8985	.9205	1.0697	1.1897	.9488	1.0023			.9747
Crushing.....cubic yards..													
Crushing.....	43,352	41,826	44,352	43,638	43,193	42,247	46,858	41,493	47,282	46,172			440,413
Operation, crushers.....	\$0.0644	\$0.0331	\$0.0266	\$0.0280	\$0.0230	\$0.0255	\$0.0186	\$0.0209	\$0.0205	\$0.0240			\$0.0283
Stone bins and conveyors.....	.0468	.0168	.0120	.0129	.0120	.0159	.0182	.0135	.0090	.0121			.0168
Power.....	.0509	.0512	.0525	.0481	.0466	.0483	.0406	.0453	.0387	.0417			.0462
Maintenance of equipment.....	.1702	.1303	.0769	.0816	.0589	.0640	.0961	.0556	.0552	.0357			.0827
Plant arbitrary.....	.1700	.2616	.2150	.2150	.2150	.2150	.3410	.3430	.3430	.3430			.2524
Total.....	.5023	.4930	.3830	.3856	.3555	.3687	.5145	.4783	.4664	.4565			.4264
Towing.....cubic yards..													
Towing.....	1.3093	1.6903	1.3702	1.4219	1.2540	1.2892	1.5842	1.6680	1.4152	1.4588			1.4011
Operation, tugs and barges.....	\$0.1645	\$0.1843	\$0.1662	\$0.1379	\$0.1583	\$0.2039	\$0.1454	\$0.1473	\$0.1341	\$0.1205			\$0.1557
Maintenance of equipment.....	.0844	.1480	.0690	.0529	.1374	.1546	.1511	.1781	.0930	.1470			.1267
Plant arbitrary.....	.1710	.2748	.2220	.2220	.2220	.2220	.1183	.1190	.1190	.1190			.1794
Total.....	.4199	.6071	.4572	.4128	.5177	.5805	.4148	.4444	.3461	.3865			.4618
Unloading.....cubic yards..													
Unloading.....	43,352	41,826	44,352	43,638	43,193	42,247	46,858	41,493	47,282	46,172			440,413
Operation, cableways and cranes.....	\$0.1270	\$0.1148	\$0.0957	\$0.0869	\$0.1101	\$0.0783	\$0.1022	\$0.0988	\$0.0825	\$0.0718			\$0.0987
Power.....	.0249	.0218	.0182	.0150	.0192	.0248	.0230	.0302	.0261	.0204			.0608

Maintenance of equipment.....	.0628	.1038	.0429	.0593	.1023	.0347	.0621	.0559	.0395	.0391	.....	.....	.0224
Plant arbitrary.....	.2070	.3312	.2680	.2680	.2680	.2680	.4504	.4530	.4530	.4530	.....	.....	.3441
Total.....	.4217	.5716	.4248	.4292	.4096	.4058	.6377	.6379	.6011	.5843	.....	.....	.5260
Rail transportation to storage, cubic yards..	17,292	18,950	17,730	19,410	13,844	12,684	10,519	8,501	10,485	9,546	206	.....	139,167
Operation of trains.....	\$0.1093	\$0.0954	\$0.1017	\$0.1033	\$0.2053	\$0.1478	\$0.2787	\$0.1835	\$0.0566	\$0.0741	\$0.2002	.....	\$0.1297
Repairs to tracks.....	.0045	.0055	.0083	.0163	.0324	.0928	.0341	.0058	.....	.....	.0868	.....	.0194
Dumping in storage.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Maintenance of equipment.....	.0670	.0768	.0669	.0760	.1176	.1210	.2770	.1294	.0610	.1145	.1822	.....	.1022
Plant arbitrary.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	.1808	.1777	.1769	.1956	.3553	.3616	.5898	.3187	.1176	.1886	.4692	.....	.2513
Division expense.....	.0406	.0438	.0325	.0288	.0225	.0234	.0205	.0196	.0184	.0203	.....	.....	.0269
Total cost in storage.....	2.2636	2.9934	2.3554	2.3797	2.4076	2.4074	2.7895	2.8352	2.4068	2.4888	.....	.....	2.4952

PACIFIC DIVISION.

ANCON QUARRY.													
Quarrying.....cubic yards..	61,362	58,962	63,426	64,446	60,430	66,101	59,043	51,081	99,523	82,770	102,302	68,462	2 839,279
Stripping.....	\$0.0217	\$0.0309	\$0.0226	\$0.0180	\$0.0090	\$0.0091	\$0.0979	\$0.1431	\$0.0609	\$0.0443	\$0.0362	\$0.0306	\$0.0423
Drilling.....	.0473	.0572	.0527	.0556	.0557	.0515	.0803	.0461	.0439	.0848	.0409	.0537	.0552
Blasting.....	.0508	.0340	.0449	.0317	.0555	.0401	.0567	.0566	.0418	.0635	.0366	.0523	.0465
Loading.....	.0389	.0382	.0382	.0347	.0415	.0309	.0446	.0234	.0271	.0417	.0340	.0375	.0356
Transportation.....	.0565	.0580	.0476	.0447	.0497	.0468	.0462	.0860	.0616	.0641	.0519	.0818	.0576
Tracks.....	.0229	.0163	.0222	.0496	.0378	.0362	.0323	.0542	.0333	.0572	.0376	.0519	.0379
Power.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Maintenance of equipment.....	.0327	.0452	.0396	.0376	.0563	.0334	.0578	.0614	.0436	.0601	.1070	.0824	.0568
Plant arbitrary.....	.2400	.2400	.2400	.2400	.2400	.2400	.1500	.1500	.1500	.1500	.1500	.1500	.1903
Total.....	.5108	.5198	.5078	.5119	.5455	.4880	.5658	.6208	.4622	.5657	.4942	.5402	.5222
Crushing.....cubic yards..	61,362	58,962	63,426	64,446	60,430	66,101	59,043	51,081	99,523	82,770	102,302	68,462	839,279
Operation, crushers.....	\$0.0184	\$0.0209	\$0.0155	\$0.0165	\$0.0184	\$0.0151	\$0.0189	\$0.0235	\$0.0236	\$0.0181	\$0.0182	\$0.0074	\$0.0179
Stone bins and conveyers.....	.0042	.0047	.0038	.0038	.0040	.0036	.0042	.0048	.0057	.0047	.0057	.0039	.0045
Power.....	.0183	.0172	.0166	.0167	.0210	.0187	.0200	.0209	.0193	.0168	.0218	.0162	.0187
Maintenance of equipment.....	.0773	.0175	.0265	.0250	.0393	.0393	.0383	.0387	.0444	.0096	.0320	.0569	.0311
Plant arbitrary.....	.0739	.0742	.0740	.0742	.0754	.0752	.0469	.0474	.0467	.0465	.0466	.0463	.0592
Total.....	.1921	.1345	.1364	.1362	.1327	.1519	.1283	.1353	.1097	.0957	.1243	.1307	.1314
Total cost of production.....	.7029	.6543	.6442	.6481	.6782	.6399	.6941	.7561	.5719	.6614	.6185	.6709	.6536

¹ Denotes credit.

² Under "Total quantities" 1,371 cubic yards have been added, to adjust the difference between cross-section measurements of stock pile and book balance. This amount was not added to monthly quantities.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 9.—Stone production—Continued.

PACIFIC DIVISION—Continued.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
ANCON QUARRY—continued.													
Rail transportation to storage, cubic yards.....	61,362	58,962	63,426	64,446	60,430	66,101	59,043	51,081	99,523	82,770	102,302	68,462	\$39,279
Operation of trains.....	\$0.0422	\$0.0402	\$0.0380	\$0.0348	\$0.0400	\$0.0346	\$0.0427	\$0.0428	\$0.0368	\$0.0351	\$0.0262	\$0.0358	\$0.0366
Repairs to tracks.....	.0024	.0033	.....	.....	.....	.0110	.0128	.0122	.0115	.0126	.0002	.....	.0064
Dumping in storage.....	.0098	.0090	.0084	.0671	.0163	.0206	.0298	.0187	.0148	.0234	.0113	.0096	.0110
Maintenance of equipment.....	.0124	.0161	.0190	.0179	.0305	.0700	.0500	.0500	.0500	.0500	.0209	.0261	.0206
Plant arbitrary.....	.0700	.0700	.0700	.0700	.0700	.0700	.0500	.0500	.0500	.0500	.0500	.0500	.0500
Total.....	.1368	.1386	.1354	.1298	.1568	.1362	.1353	.1237	.1131	.1211	.1086	.1215	.1276
Division expense.....	.0206	.0199	.0141	.0150	.0158	.0148	.0264	.0254	.0148	.0213	.0165	.0210	.0184
Total cost in storage.....	.8603	.8128	.7937	.7929	.8508	.7909	.8558	.9052	.6998	.8038	.7436	.8134	.7996

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.
TABLE 10.—*Sand production.*
ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
NOMBRE DE DIOS.													
Dredging.....cubic yards..	24,512	27,818	32,401	39,444	19,948								144,123
Operation, dredges.....	\$0.2753	\$0.2088	\$0.1709	\$0.1488	\$0.1843								\$0.1912
Maintenance of equipment.....	1.0295	.0113	.0524	.0344	.0927								.1309
Total.....	.2458	.2171	.2293	.1832	.2770								.3222
Plant arbitrary.....	.4800	1.0613	.7890	.7890	.7890								.7890
Total cost of production.....	.7258	1.2784	1.0183	.9722	1.0660								1.1112
Towing.....cubic yards..													
Operation, tugs and barges.....	24,512	27,818	32,401	39,444	19,948								144,123
Maintenance of equipment.....	\$0.2297	\$0.2244	\$0.2240	\$0.2048	\$0.2449								\$0.2235
Plant arbitrary.....	.0838	.1630	.1251	.0832	.1140								.1311
Total.....	.2110	.3446	.2820	.2820	.2820								.2820
Unloading.....cubic yards..													
Operation, cableways and cranes.....	.5245	.7320	.6311	.5700	.6409								.6366
Power.....	24,512	27,818	32,401	39,444	19,948								144,123
Maintenance of equipment.....	\$0.1123	\$0.1185	\$0.0951	\$0.0845	\$0.1042								\$0.1027
Plant arbitrary.....	.0153	.0235	.0217	.0198	.0106								.0189
Total.....	.0305	.1104	.0472	.0372	.0746								.0712
Plant arbitrary.....	.1620	.2654	.2170	.2170	.2170								.2170
Total.....	.3501	.5178	.3820	.3885	.4004								.4098
Rail transportation to storage.cubic yards..													
Operation of trains.....	11,553	13,432	11,743	12,001	11,705								60,494
Repairs to tracks.....	\$0.1093	\$0.0954	\$0.1017	\$0.1032	\$0.0874								\$0.0993
Dumping in storage.....	.0045	.0055	.0083	.0163	.0138								.0096
Maintenance of equipment.....	.0670	.0768	.0659	.0760	.0500								.0677
Plant arbitrary.....													
Total.....	.1808	.1777	.1769	.1955	.1512								.1766
Division expense.....	.0122	.0115	.0085	.0059	.0131								.0096
Total lost in storage.....	1.6977	2.6255	2.1040	1.9904	2.2151								2.2414

1 Indicates credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 10.—*Sand production*—Continued.

ATLANTIC DIVISION—Continued.

Items	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN.													
Dredging.....cubic yards.											10,252	30,279	40,531
Operation, dredges.....											\$0.2161	\$0.1830	\$0.1915
Maintenance of equipment.....											.0263	.0495	.0436
Total.....											.2424	.2325	.2351
Plant arbitrary.....											.7760	.7041	.7671
Total cost of production.....											1.0184	.9966	1.0022
Towing.....cubic yards.											8,550	30,210	38,760
Operation, tugs and barges.....											\$0.1525	\$0.0447	\$0.0684
Maintenance of equipment.....											.0792	.0060	.0222
Total.....											.2317	.0507	.0906
Unloading.....cubic yards.											8,550	30,210	38,760
Operation, cableways and cranes.....											\$0.0600	\$0.0507	\$0.0541
Power.....											.0107	.0171	.0157
Maintenance of equipment.....											.0559	.0458	.0480
Total.....											.1326	.1136	.1178
Rail transportation to storage.....cubic yards.											1,702	69	1,771
Operation of cranes.....											\$0.2262	.....	\$0.2174
Operation of trains.....											.0628	.....	.0604
Repairs to tracks.....											.0055	\$8.4058	.9094
Maintenance of equipment.....											.2134	1.9094	.2795
Total.....											1.1079	10.3152	1.4667
Division expense.....											.0272	.0167	.0194
Total cost in storage.....											1.5334	1.2008	1.2850

PACIFIC DIVISION.

CHARGE.	33, 914	41, 029	39, 863	45, 789	35, 803	42, 201	50, 287	48, 389	51, 138	51, 245	65, 641	59, 538	564, 837
Dredging.....cubic yards..	\$0.1294	\$0.0852	\$0.0960	\$0.0859	\$0.1172	\$0.1316	\$0.0746	\$0.0754	\$0.0808	\$0.0982	\$0.0696	\$0.0770	\$0.0905
Operation, dredges	.0454	.0972	.0403	.0206	.1523	.0218	.0175	.0379	.0227	.0281	.0213	.0270	.0403
Maintenance of equipment.....													
Total.....	.1748	.1824	.1363	.1065	.2695	.1534	.0921	.1133	.1035	.1263	.0909	.1040	.1308
Plant arbitrary.....	.0300	.0300	.0300	.0300	.0300	.0300	.0100	.0100	.0100	.0100	.0100	.0100	.0202
Total cost of production.....	.2048	.2124	.1663	.1365	.2995	.1834	.1021	.1233	.1135	.1363	.1009	.1140	.1510
Towing.....cubic yards..	33, 914	41, 029	39, 863	45, 789	35, 803	42, 201	50, 287	48, 389	51, 138	51, 245	65, 641	59, 538	564, 837
Operation, tugs and barges.....	\$0.1289	\$0.1084	\$0.1051	\$0.0933	\$0.0967	\$0.0889	\$0.0874	\$0.0786	\$0.0841	\$0.0762	\$0.0991	\$0.0917	\$0.0936
Maintenance of equipment.....	.0692	.0558	.0512	.0281	.0301	.0378	.0392	.0368	.0588	.0425	.0319	.1042	.0493
Plant arbitrary.....	.0600	.0417	.0500	.0500	.0500	.0500	.0200	.0200	.0200	.0200	.0200	.0200	.0309
Total.....	.2581	.2059	.2063	.1714	.1768	.1767	.1466	.1354	.1629	.1387	.1510	.2159	.1738
Unloading.....cubic yards..	33, 914	41, 029	39, 863	45, 789	35, 803	42, 201	50, 287	48, 389	51, 138	51, 245	65, 641	59, 538	564, 837
Operation, cableways and cranes.....	\$0.0796	\$0.0635	\$0.0652	\$0.0576	\$0.0810	\$0.0746	\$0.0623	\$0.0569	\$0.0687	\$0.0566	\$0.0540	\$0.0683	\$0.0645
Power.....	.0309	.0253	.0259	.0230	.0273	.0231	.0202	.0174	.0164	.0154	.0081	.0151	.0196
Maintenance of equipment.....	.0137	.0552	.0582	.0345	.0148	.0158	.0205	.0377	.0171	.0290	.0431	.0510	.0335
Plant arbitrary.....	.1036	.0667	.0833	.0831	.0837	.0832	.0343	.0336	.0333	.0332	.0330	.0333	.0545
Total.....	.2278	.2107	.2326	.1982	.2068	.1967	.1373	.1456	.1355	.1342	.1382	.1677	.1722
Rail transportation to storage..cubic yards..	33, 914	41, 029	39, 863	45, 789	35, 803	42, 201	50, 287	48, 389	51, 138	51, 245	65, 641	59, 538	564, 837
Operation of trains.....	\$0.0550	\$0.0463	\$0.0432	\$0.0373	\$0.0464	\$0.0396	\$0.0358	\$0.0352	\$0.0375	\$0.0433	\$0.0362	\$0.0375	\$0.0403
Repairs to tracks.....	.0630	.0273	.0384	.0633	.1011	.0336	.0314	.0311	.0260	.0356	.0072	.0235	.0369
Dumping in storage.....	.0179	.0132	.0125	.0152	.0128	.0110	.0101	.0100	.0082	.0153	.0109	.0106	.0120
Maintenance of equipment.....	.0167	.0192	.0220	.0198	.0372	.0241	.0264	.0159	.0156	.0293	.0306	.0287	.0241
Plant arbitrary.....	.0900	.0900	.0900	.0900	.0900	.0900	.0700	.0700	.0700	.0700	.0700	.0700	.0785
Total.....	.2426	.1960	.2061	.2256	.2875	.1983	.1737	.1622	.1573	.1935	.1549	.1703	.1918
Division expense.....	.0191	.0134	.0116	.0148	.0207	.0125	.0107	.0126	.0139	.0133	.0112	.0145	.0137
Total cost in storage.....	.9524	.8384	.8229	.7465	.9913	.7676	.5704	.5791	.5831	.6160	.5562	.6824	.7025

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 11.—*Manufacturing concrete piles.*

ATLANTIC DIVISION.

Items.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Concrete piles.....linear feet..	1,500	750	10,455	31,140	29,850								73,695
Cement.....	\$0.0860	\$0.0930	\$0.0799	\$0.0838	\$0.0845								\$0.0837
Stone.....	.0671	.0820	.0679	.0613	.0661								.0645
Sand.....	.0178	.0092	.0085	.0090	.0083								.0388
Mixing.....	.0511	.2083	.0789	.0296	.0527								.0482
Placing.....	.0744	.1348	.0436	.0456	.0382								.0438
Reinforcements.....	1.0581	.7729	.6990	.7123	.7052								.7152
Forms.....	.2320	.1292	.0829	.0592	.0293								.0547
Maintenance of equipment.....	.0410	.0158	.0005	.0044	1.0007								.0026
Plant arbitrary.....	.1700	.2030	.1810	.1810	.1810								.1810
Division expense.....	.0624	.0502	.0207	.0097	.0105								.0131
Total cost.....	1.8599	1.7014	1.2629	1.1959	1.1751								1.2156

¹ Denotes credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—Continued.

TABLE 12.—Operation power plants.

ATLANTIC DIVISION.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
GATUN POWER PLANT.													
Output.....kilowatt hours.	1,578,500	1,590,760	1,448,620	1,627,890	1,353,080	1,284,180	1,383,800	1,001,260	1,268,130	1,355,540	1,251,420	1,111,330	16,263,510
Operation.....	\$0.0012	\$0.0019	\$0.0010	\$0.0018	\$0.0023	\$0.0025	\$0.0020	\$0.0029	\$0.0016	\$0.0016	\$0.0016	\$0.0020	\$0.0018
Fuel.....	.0084	.0089	.0099	.0084	.0081	.0082	.0077	.0079	.0078	.0077	.0080	.0081	.0083
Repairs to equipment.....	.0022	.....	.0047	.0009	.0007	.0009	.0021	.0008	.0014	.0023	1.0004	.0008	.0014
Plant arbitrary.....	.0110	.0110	.0110	.0110	.0110	.0110	.0110	.0110	.0110	.0080	.0080	.0080	.0103
Division expense.....	.0002	.0002	.0002	.0002	.0001	.0002	.0002	.0002	.0001	.0001	.0001	.0003	.0002
Total.....	.0230	.0220	.0268	.0223	.0222	.0228	.0230	.0228	.0219	.0197	.0173	.0192	.0220

PACIFIC DIVISION.

MIRAFLORES POWER PLANT.													
Output.....kilowatt hours.	656,780	771,430	626,410	705,700	663,160	702,350	762,030	664,940	884,310	1,089,180	1,013,910	982,200	9,522,400
Operation.....	\$0.0039	\$0.0033	\$0.0039	\$0.0038	\$0.0040	\$0.0027	\$0.0032	\$0.0035	\$0.0032	\$0.0023	\$0.0026	\$0.0024	\$0.0031
Fuel.....	.0087	.0080	.0088	.0082	.0082	.0078	.0081	.0080	.0083	.0076	.0080	.0077	.0081
Repairs to equipment.....	.0053	.0026	.0019	.0015	.0008	.0007	.0016	.0008	.0010	.0006	.0010	.0014	.0014
Plant arbitrary.....	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
Division expense.....	.0004	.0033	.0003	.0003	.0003	.0003	.0002	.0003	.0002	.0002	.0002	.0002	.0003
Total.....	.0283	.0242	.0249	.0238	.0233	.0215	.0231	.0226	.0230	.0207	.0218	.0207	.0209

1 Indicates a credit.

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—
Continued.TABLE NO. 13.—*Lighting and buoying canal.*

	Quantities.	Amount.	Unit cost.
Preliminary work:			
Surveys.....		\$14,868.02	
Division expense.....		2,859.10	
Total division cost.....		17,727.12	
Administrative and general expense.....		2,456.39	
Total cost.....		20,183.51	
	<i>Acres.</i>		
Clearing.....	809.85	15,468.93	\$19.1010
Division expense.....	809.85	2,922.60	3.6088
Total division cost.....	809.85	18,391.53	22.7098
Administrative and general expense.....	809.85	2,541.55	3.1383
Total cost.....	809.85	20,933.08	25.8481
Total, preliminary work.....		41,116.59	
Range lights 9-11, Pacific division:	<i>Cubic yds.</i>		
Foundations—			
Masonry.....	194.00	6,074.00	31.3093
Structures—			
Masonry.....	62.57	3,138.07	50.1529
Handling material.....	256.57	684.55	2.6681
Division expense.....	256.57	1,206.50	4.7024
Total division cost.....	256.57	11,103.12	43.2752
Administrative and general expense.....	256.57	781.03	3.0441
Total cost.....	256.57	11,884.15	46.3193
Range lights 13-14, Pacific division:			
Foundations—			
Excavation.....		161.42	
Masonry.....	99.20	2,997.65	30.2182
Structures—			
Masonry.....	79.52	1,713.27	21.5451
Handling material.....	178.72	2,169.04	12.1365
Division expense.....	178.72	960.33	5.3734
Total division cost.....	178.72	8,001.71	44.7723
Administrative and general expense.....	178.72	621.67	3.4785
Total cost.....	178.72	8,623.38	48.2508
Range lights 1-2, Pacific division:			
Foundations—			
Masonry.....		430.44	
Structures—			
Masonry.....	22.05	573.07	25.9896
Handling material.....		347.92	
Division expense.....		204.86	
Total division cost.....		1,556.29	
Administrative and general expense.....		132.69	
Total cost.....		1,688.98	
Range lights 5-6, Atlantic division:			
Foundations—			
Excavation.....	45.00	62.98	1.3996
Masonry.....	38.90	731.59	18.8069
Structures—			
Masonry.....	96.42	3,011.37	31.2318
Stairways.....		357.00	
Handling material.....	135.32	1,034.15	7.6423
Division expense.....	135.32	732.35	5.4120
Total division cost.....	135.32	5,929.44	43.8179
Administrative and general expense.....	135.32	480.34	3.5497
Total cost.....	135.32	6,409.78	47.3676

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—
Continued.TABLE NO. 13.—*Lighting and buoying canal*—Continued.

	Quantities.	Amount.	Unit cost.
Range lights 21-22, Lake:			
Foundations—	<i>Cubic yds.</i>		
Excavation.....	2.00	\$37.59	\$18.7950
Masonry.....	10.48	151.64	14.4695
Structures—			
Masonry.....	10.92	595.04	54.4908
Handling material.....	21.40	526.57	24.6061
Division expense.....	21.40	206.10	9.6308
Total division cost.....	21.40	1,516.94	70.8850
Administrative and general expense.....	21.40	133.44	6.2355
Total cost.....	21.40	1,650.38	77.1205
Range lights 24-25, Lake:			
Foundations—			
Excavation.....		75.82	
Masonry.....	19.90	323.01	16.2317
Structures—			
Masonry.....	62.57	1,773.79	28.3489
Stairways.....		202.37	
Handling material.....	82.47	1,274.35	15.4523
Division expense.....	82.47	578.41	7.0136
Total division cost.....	82.47	4,227.75	51.2641
Administrative and general expense.....	82.47	374.42	4.5401
Total cost.....	82.47	4,602.17	55.8042
Range lights 1-2, Lake:			
Foundations—			
Excavation.....	400.00	490.38	1.2260
Masonry.....	87.30	2,518.76	28.8518
Structures—			
Masonry.....	22.05	905.36	41.0594
Stairways.....		37.97	
Handling material.....	109.35	503.42	4.6037
Division expense.....	109.35	503.23	4.6020
Total division cost.....	109.35	4,959.12	45.3509
Administrative and general expense.....	109.35	325.77	2.9791
Total cost.....	109.35	5,284.89	48.3300
Range lights 5-6, Lake:			
Foundations—			
Excavation.....		40.34	
Masonry.....		324.70	
Structures—			
Masonry.....		37.99	
Handling material.....		1,071.88	
Division expense.....		206.44	
Total division cost.....		1,681.35	
Administrative and general expense.....		133.64	
Total cost.....		1,814.99	
West Breakwater light:			
Foundations—			
Masonry.....		6,451.78	
Handling material.....		289.49	
Division expense.....		622.89	
Total division cost.....		7,364.16	
Administrative and general expense.....		403.00	
Total cost.....		7,767.16	
Beacons, common:			
Structures.....		3,122.97	
Handling material.....		273.63	
Division expense.....		297.88	
Total division cost.....		3,694.48	
Administrative and general expense.....		192.47	
Total cost.....		3,886.95	

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—
Continued.TABLE NO. 13.—*Lighting and buoying canal*—Continued.

	Quantities.	Amount.	Unit cost.
Beacons, special, for Pacific entrance:	<i>Cubic yds.</i>		
Foundations.....		\$1,188.00	.....
Structures.....		1,623.18	.....
Handling material.....		31.19	.....
Division expense.....		20.56	.....
Total division cost.....		2,862.93	.....
Administrative and general expense.....		13.28	.....
Total cost.....		2,876.21	.....
Ventilation, doors, etc.....		1,374.82	.....
Lenses and headlights.....		416.53	.....
Acetylene-gas installation, including charging plant		3,033.40	.....
Booy sinkers:			
Sinkers (concrete).....		1,545.41	.....
Division expense.....		141.59	.....
Total division cost.....		1,687.00	.....
Administrative and general expense.....		91.52	.....
Total cost.....		1,778.52	.....
Items held in suspense for future distribution:			
Stairways and windows.....		1,402.58	.....
Division expense.....		122.52	.....
Total division cost.....		1,525.10	.....
Administrative and general expense.....		77.98	.....
Total cost.....		1,603.08	.....
Carpentry work—			
Work cost.....		164.21	.....
Division expense.....		36.76	.....
Total division cost.....		200.97	.....
Administrative and general expense.....		23.56	.....
Total cost.....		224.53	.....
Handling material—			
Handling.....		616.57	.....
Division expense.....		113.65	.....
Total division cost.....		730.22	.....
Administrative and general expense.....		73.52	.....
Total cost.....		803.74	.....
Temporary structures—			
Structures.....		4,446.19	.....
Division expense.....		202.47	.....
Total division cost.....		4,648.66	.....
Administrative and general expense.....		131.02	.....
Total cost.....		4,779.68	.....
Total cost, lighting and buoying canal.....		111,619.93	.....

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—
Continued.TABLE NO. 14.—*Hydraulic filling in city of Colon, fiscal year 1912.*

Items.	July.	August.	Total.
Hydraulic filling.....cubic yards..	124,950	4,989	129,939
Surveys.....	\$0.0046	\$0.0022	\$0.0044
Pipe-line dredges—			
Operation.....	.0835	.1453	.0859
Repairs.....	.0036	3.1115	.1229
Pipe lines, dikes, etc.....	.0140	.3678	.0276
Division expense.....	.0036	.1620	.0097
Total division cost.....	.1093	3.7888	.2505
Administrative and general expenses.....	.0089	.3197	.0209
Total cost.....	.1182	4.1085	.2714

TABLE 15.—*Detail cost of installation of spillways and locks machinery (first division chief engineer's office).*

	Quantities.	Amount.	Unit cost.
ATLANTIC DIVISION.			
Gatun spillway:			
Gates—	<i>Lin. feet.</i>		
Installation.....		\$1,185.27	.....
Contract material.....		28,796.44	.....
Total.....		29,981.71	.....
Gatun Locks:			
Preliminary expenditures—			
Testing.....		13,316.32	.....
Handling material.....		18,183.97	.....
Operating, and repairs of miscellaneous tools, etc.....		34,979.72	.....
East wall trestle repairs.....		796.70	.....
Culebra office.....		2,999.51	.....
General administrative expenses.....		2,553.79	.....
General expense.....		19,489.59	.....
Total.....		92,319.60	.....
Miter gate moving machines—			
Installation, incomplete.....		2,960.52	.....
Contract material.....		16,846.03	.....
Concrete used.....		3,470.50	.....
Total.....		23,277.05	.....
Miter forcing machines—			
Installation, incomplete.....		138.07	.....
Contract material.....		1,205.60	.....
Total.....		1,343.67	.....
Rising stem valve machines—			
Installation, incomplete.....		7,593.88	.....
Contract material.....		56,862.56	.....
Concrete used.....		6,708.38	.....
Total.....		71,164.82	.....
Rising stem valves—			
Installation, incomplete.....		9,375.13	.....
Contract material.....		62,257.95	.....
Total.....		71,633.08	.....
Cylindrical valve machines—			
Installation, incomplete.....		2,302.58	.....
Contract material.....		22,916.38	.....
Concrete used.....		899.01	.....
Total.....		26,117.97	.....
Cylindrical valves—installation, incomplete.....		54.04	.....
Auxiliary culvert valves—			
Installation, incomplete.....		44.58	.....
Contract material.....		1,830.64	.....
Total.....		1,875.22	.....

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—
Continued.TABLE 15.—Detail cost of installation of spillways and locks machinery (first division
chief engineer's office)—Continued.

	Quantities.	Amount.	Unit cost.
ATLANTIC DIVISION—continued.			
Gatun Locks—Continued.			
Caisson sills—	<i>Lin. feet.</i>		
Installation.....		\$1,784.10	.....
Concrete used.....		68.70	.....
Total.....		1,852.80	.....
Rack track and return track—			
Rack track—			
Mechanical.....	6,162	\$11,123.65	\$1.8052
Contract material.....		131,046.76	
Electrical.....	6,162	1,481.31	.2404
Contract material.....		72,488.98	
Concrete used.....		6,682.78	
Total first division.....		222,823.48	
Return track—installed by Atlantic division.....	6,169	8,842.22	1.4330
Total.....		231,665.70	
Decking—			
Installation.....		141.21	
Contract material and Gorgona casting.....		21,286.54	
Concrete used.....		2,166.49	
Total.....		23,594.24	
Recess covers—			
Installation.....		413.92	
Concrete used.....		6,075.98	
Total.....		6,489.90	
Power control and lights—contract material.....		1,152.00	
Screening rock—concrete used.....		300.75	
Repairs to mixers—concrete used.....		996.47	
Total cost Gatun Locks.....		553,837.31	
Cost of concrete used (included in detail above):	<i>Cu. yds.</i>		
Forms.....	2,052.9	9,599.44	4.6760
Reinforcements.....	2,052.9	166.89	.0813
Placing concrete.....	2,052.9	4,938.54	2.4056
Mixed concrete from Atlantic division.....	2,052.9	1,217.76	.5932
Cement.....	2,052.9	4,317.67	2.1032
Sand.....	2,052.9	1,761.36	.8580
Stone.....	2,052.9	4,070.18	1.9826
Screening rock.....	2,052.9	300.75	.1466
Repairs to mixers.....	2,052.9	996.47	.4854
Total.....	2,052.9	27,369.06	13.3319
PACIFIC DIVISION.			
Pedro Miguel Locks:			
Preliminary expenditures—			
Testing.....		943.16	
Handling material.....		2,313.00	
Operation and repairs of miscellaneous tools, etc.....		5,178.98	
Culebra office.....		921.65	
General administrative expenses.....		769.40	
General expense.....		5,463.42	
Total.....		15,589.61	
Miter gate moving machines—			
Installation incomplete.....		1,109.66	
Concrete used.....		141.52	
Total.....		1,251.18	
Rising stem valve machines—			
Installation incomplete.....		1,940.96	
Contract material.....		13,100.00	
Concrete used.....		1,357.18	
Total.....		16,398.14	

EXHIBIT B.—DETAIL COST PER UNIT OF WORK BY MONTHS—FISCAL YEAR 1912—
Continued.TABLE 15.—Detail cost of installation of spillways and locks machinery (first division
chief engineer's office)—Continued.

	Quantities.	Amount.	Unit cost.
PACIFIC DIVISION—continued.			
Pedro Miguel Locks—Continued.	<i>Cu. yds.</i>		
Rising stem valves—installation incomplete.....		\$2,474.36	
Cylindrical valve machines—			
Installation incomplete.....		951.14	
Contract material.....		9,422.00	
Concrete used.....		175.79	
Total.....		10,548.93	
Chain fenders—installation incomplete.....		34.60	
Auxiliary culvert machines—installation incomplete.....		17.00	
Rack track and return track—			
Rack track—	<i>Linear feet.</i>		
Mechanical.....	4,438	5,768.81	\$1.2999
Contract material.....		55,789.83	
Electrical.....	4,438	70.96	.0159
Contract material.....		45,792.08	
Concrete used.....		7,050.02	
Total first division.....		114,471.70	
Return track installed by Pacific division.....	3,390	3,278.16	.9670
Total.....		117,749.86	
Decking—			
Installation.....		17.12	
Contract material.....		8,196.12	
Concrete used.....		233.20	
Total.....		8,446.44	
Recess covers—			
Installation.....		38.39	
Concrete used.....		1,231.09	
Total.....		1,269.48	
Power control and lights—contract material.....		444.33	
Repairs to mixers—concrete used.....		105.53	
Total Pedro Miguel Locks.....		174,329.46	
Cost of concrete used (included in detail above)—	<i>Cubic yards.</i>		
Forms.....	296	6,773.06	22.8818
Placing concrete.....	296	1,476.39	4.9878
Cement.....	296	834.16	2.8181
Sand.....	296	184.56	.6236
Stone.....	296	317.50	1.0726
Chipping concrete.....	296	603.13	2.0376
Repairs to mixers.....	296	105.53	.3566
Total.....	296	10,294.33	34.7781
Miraflores Locks:			
Preliminary expenditures—			
General administrative expenses.....		3,036.02	
General expense.....		21,890.26	
Total.....		24,926.28	
Rising stem valve machines—contract material.....		16,200.00	
Rack track and return track—			
Rack track—	<i>Linear feet.</i>		
Mechanical—contract material.....		62,034.64	
Electrical—contract material.....		59,536.15	
Total first division.....		121,570.79	
Return track installed by Pacific division.....	1,182	2,702.83	2.2867
Total.....		124,273.62	
Power control and lights—contract material.....		888.67	
Decking—contract material and Gorgona castings.....		771.25	
Total Miraflores Locks.....		167,059.82	
Total all locks and spillways.....		925,208.30	

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912.

TABLE 1.—Performance of crushers at Porto Bello quarry, fiscal year ended June 30, 1912.

ATLANTIC DIVISION.

[Plant consists of one No. 21, two No. 9, and four No. 6 crushers, working through largest to smallest crusher.]

Month.	Crushed rock produced.	Crush- ing.	Delays.							Total unit hours operated per month.	Average quantity produced per hour.		Per cent of hours at work to hours operated.
			Repair- ing crusher.	Repair- ing cross convey- ors.	Repair- ing bin convey- ors.	Crusher choked.	Waiting for stone.	Bins full; no barges.	Other delays.		Total delays.	Work- ing time.		Total time.
	<i>Cu. yds.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	
July.....	43,352	117.43	1.03	0.59	3.02	1.00	31.55	30.15	14.63	82.57	369.17	216.76	58.72
August.....	41,826	107.45	.....	.75	1.02	1.75	96.43	6.84	1.76	108.55	389.26	193.64	49.75
September.....	44,352	108.18	5.35	2.16	.43	1.10	60.95	20.04	1.79	91.82	409.98	221.76	54.09
October.....	43,638	105.64	2.08	.67	3.66	2.63	73.74	14.16	5.42	102.36	413.08	209.79	50.79
November.....	43,193	99.77	.50	1.33	.17	1.75	56.98	26.08	5.42	92.23	432.93	224.96	51.96
December.....	42,247	90.21	.....	.83	.....	1.16	97.21	9.17	1.42	109.79	408.32	211.24	45.11
January.....	46,858	97.67	.93	.....	.67	1.88	61.53	34.82	10.59	110.33	479.76	225.28	46.96
February.....	41,493	82.13	.59	.67	.33	.....	40.00	59.77	8.51	109.87	505.21	216.11	42.78
March.....	47,282	103.18	.....	4.00	.....	.....	44.38	43.43	13.01	104.82	458.25	227.32	49.61
April.....	46,172	97.17	.25	.....	2.08	.....	56.44	31.41	12.65	102.83	475.17	230.86	48.59
Total.....	440,413	1,008.83	10.73	11.00	11.98	11.27	619.21	275.87	75.11	1,015.17	436.56	217.60	49.84
Per cent of total.....	.....	49.84	.53	.54	.59	.56	30.60	13.63	3.71	50.16	.....	.....	.....

Operations ceased on Apr. 30, sufficient crushed stone being then in storage at Gatun to complete the spillway and locks. Plant was operated eight hours per day during the period.

TABLE 2.—Performance of unloading cableways, Gatun, fiscal year ended June 30, 1912.

[Plant consists of two duplex and one single cableway towers.]

ATLANTIC DIVISION.

Month.	Average number of cables operated.	Material handled.	Unloading.	Delays.					Total unit hours operated per month.	Rates per hour per cable.		Per cent of hours at work to hours operated.
				Repairs.	Power off.	Moving barges.	Waiting on barges.	Other delays.		Working time.	Total time.	
		Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.		Cu. yds.	Cu. yds.	
July.....	5	30,232	621.88	38.75	23.13	25.97	170.00	33.27	913.00	48.61	33.11	68.11
August.....	5	29,914	586.50	126.13	16.25	27.68	323.83	22.30	1,099.09	51.00	27.20	53.33
September.....	5	39,973	788.38	40.31	27.74	28.95	141.01	29.12	1,055.51	50.70	37.87	74.09
October.....	5	46,899	783.34	135.17	15.85	29.59	56.90	56.08	1,076.93	59.87	43.55	72.74
November.....	4.54	33,141	621.02	49.05	44.39	16.30	81.82	44.79	857.97	53.37	38.63	72.38
December.....	4	27,391	467.66	59.75	6.90	8.99	212.53	44.17	800.00	58.57	34.24	58.46
January.....	4	27,244	580.61	32.79	10.57	31.15	217.24	63.64	936.00	46.92	29.11	62.03
February.....	4	21,049	452.79	23.08	13.94	22.40	294.12	57.67	864.00	46.49	24.36	52.41
March.....	4	26,370	555.91	23.34	6.80	16.28	273.05	60.62	936.00	47.44	28.17	59.39
April.....	4	27,727	562.71	36.88	13.01	23.24	192.16	36.00	864.00	49.27	32.09	65.13
May.....	5	7,121	113.34	13.91	5.91	2.22	1,007.91	26.71	1,170.00	62.83	6.09	9.09
June.....	3	29,706	441.27	69.69	26.35	5.51	35.74	246.44	825.00	67.32	36.01	53.49
Total.....	4.39	346,767	6,575.41	649.45	210.84	238.28	3,003.31	720.81	11,398.10	52.74	30.42	57.09
Per cent of total.....			57.69	5.70	1.85	2.09	26.35	6.32	100.00			

This plant was operated 8 hours per day from July 1, 1911, to May 31, 1912; and 12 hours per day from June 1 to June 30, 1912. Quantities shown are bucket measurements.

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912—Continued.

TABLE 3.—Performance of unloading derricks, Gatun, fiscal year ended June 30, 1912.

[Plant consists of five boom derricks.]

ATLANTIC DIVISION.

Month.	Average number of derricks used.	Material handled.	Unloading.	Delays.					Total unit hours operated per month.	Rates per hour per derrick.		Per cent of hours at work to hours operated.
				Repairs.	Moving barges.	Waiting on cars.	Waiting on barges.	Other delays.		Working time.	Total time.	
			Hours.	Hours.	Hours.	Hours.	Hours.	Hours.		Cubic yds.	Cubic yds.	
July.....	5.00	28,837	584.95	129.10	38.57	43.43	30.33	118.79	945.17	49.30	30.51	61.89
August.....	5.00	32,382	654.77	100.00	32.70	37.45	6.17	105.23	936.32	49.46	34.58	69.93
September.....	5.00	29,461	601.53	82.96	37.05	106.78	20.33	54.00	902.65	49.98	32.64	66.04
October.....	5.00	31,472	569.52	106.74	37.41	183.07	70.88	109.73	1,077.35	55.26	29.21	52.86
November.....	3.25	18,823	347.00	55.65	18.17	126.32	68.79	68.13	684.06	54.24	27.52	50.73
December.....	3.00	12,684	266.44	34.34	10.68	13.59	235.88	39.07	600.00	47.61	21.14	44.41
January.....	3.00	10,519	221.36	13.78	11.45	28.11	307.20	34.10	616.00	47.52	17.08	35.94
February.....	3.00	8,501	151.60	7.87	17.58	24.07	298.65	36.23	576.00	44.37	14.76	33.26
March.....	3.00	10,485	214.85	8.58	18.09	47.18	293.07	42.23	624.00	48.80	16.80	34.43
April.....	3.00	9,546	211.68	7.92	16.44	30.52	275.01	34.43	576.00	45.10	16.57	36.75
May.....	1.00	206	5.00	.....	.....	.....	3.00	.....	8.00	41.20	25.75	62.50
Total.....	3.83	192,916	3,868.70	546.94	238.14	640.52	1,609.31	641.94	7,545.55	49.87	25.57	51.27
Per cent of total.....	.....	.....	51.27	7.25	3.16	8.48	21.33	8.51	100.00	.....	.....	.....

Five derricks were operated from July 1, 1911, to Nov. 15, 1911, and 3 from Nov. 16, 1911, to Apr. 29, 1912. Plant was operated eight hours per day.

TABLE 4.—Performance of construction plant mixers, Gatun, fiscal year ended June 30, 1912.

[Plant consists of a battery of eight 2-cubic-yard mixers].

ATLANTIC DIVISION.

Month	Average number of mixers operated.	Concrete mixed.	Mixing.	Delays.				Total unit hours operated per month.	Average concrete mixed.		Per cent of hours mixing to hours operated.
				Repairing.	Waiting for cars.	Other delays.	Total delays.		Per hour mixing.	Per hour operated.	
July.....	6.84	Cubic yards. 47,856	Hours. 787.38	Hours.	Hours. 1,028.10	Hours.	Hours. 1,028.10	1,815.48	Cubic yards. 60.78	Cubic yards. 26.36	43.37
August.....	6.93	47,332	795.92	.....	1,042.93	.....	1,042.93	1,838.85	59.47	25.74	43.28
September.....	4.72	46,098	734.29	.....	504.36	.....	504.36	1,238.65	62.78	37.22	59.28
October.....	5.35	41,308	689.44	.....	789.23	.....	789.23	1,478.67	59.92	27.94	46.63
November.....	5.88	33,038	577.62	.....	876.51	.....	876.51	1,454.13	57.20	22.72	39.72
December.....	4.27	31,174	527.91	.....	751.90	.....	751.90	1,279.81	59.05	24.36	41.25
January.....	3.47	26,544	476.61	.....	605.09	.....	605.09	1,081.70	55.69	24.54	44.06
February.....	3.70	21,046	345.76	.....	454.73	.....	454.73	800.49	60.87	26.29	43.19
March.....	3.98	25,084	437.64	.....	494.33	.....	494.33	931.97	57.32	26.92	46.96
April.....	2.83	10,862	201.71	.....	432.18	.....	432.18	633.89	53.85	17.14	31.82
May.....	2.00	6,916	115.36	.....	372.17	.....	372.17	487.53	59.95	14.19	23.66
June.....	1.75	6,106	104.66	.....	307.23	.....	307.23	411.89	58.34	14.82	25.41
Total.....	4.30	343,364	5,794.30	.....	7,658.76	.....	7,658.76	13,453.06	59.26	25.52	43.07
Per cent of total.....	.....	.....	43.07	.....	56.93	.....	56.93	100.00	.....	.....	.....

Plant worked 12 hours per day from July 1, 1911, to Jan. 31, 1912, and 9 hours per day from Feb. 1 to June 30, 1912. Quantities shown are bucket measurement.

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912—(Continued).

TABLE 5.—Performance of auxiliary mixers, Gatun, fiscal year ended June 30, 1912.

[Plant consists of a battery of two 2-cubic yard mixers].

ATLANTIC DIVISION.

Month.	Average number of mixers operated.	Concrete mixed.	Mixing.	Delays.				Total unit hours operated per month.	Average concrete mixed.		Per cent of hours mixing to hours operated.
				Repairing.	Waiting for cars.	Other delays.	Total delays.		Per hour mixing.	Per hour operated.	
July.....	2.00	Cubic yards.	Hours.	Hours.	Hours.	Hours.	Hours.	448.00	Cubic yards.	Cubic yards.	49.69
August.....	2.00	16,868	222.63	7.67	203.93	13.77	225.37	477.00	75.76	42.12	45.67
September.....	2.00	13,464	217.83	.25	258.00	.92	259.17	441.75	61.81	28.23	38.65
October.....	2.00	8,332	170.75	.....	271.00	.....	271.00	459.42	48.80	18.86	33.79
November.....	2.00	9,882	155.24	3.01	293.00	8.17	304.18	441.75	63.66	21.51	23.28
December.....	2.00	8,732	98.73	1.67	313.17	10.51	325.35	424.08	88.44	20.59	29.15
January.....	2.00	10,200	128.75	.....	312.00	1.00	313.00	441.75	79.22	23.09	21.06
February.....	1.33	6,870	96.75	.....	362.00	.67	362.67	459.42	71.01	14.95	16.15
March.....	1.00	5,188	68.49	.....	355.59	.....	355.59	424.08	75.75	12.23	30.24
		1,008	16.02	.....	36.96	.....	36.96	52.98	62.92	19.03	
Total.....	1.89	80,544	1,175.19	12.60	2,405.65	35.04	2,453.29	3,628.48	68.54	22.20	32.39
Per cent of total.....	.....	.....	32.39	.25	66.30	.96	67.61	100.00	.....	.....	.....

Plant worked on 1st, 2d, 4th, 5th, 6th, and 11th of March. Closed down Mar. 12 and dismantled. Plant was operated with one shift throughout the period. Quantities shown are bucket measurement.

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912—Continued.

TABLE 6.—Performance of locks cableway towers, Gatun, fiscal year ended June 30, 1912.

[Plant consists of four duplex cableway towers.]

ATLANTIC DIVISION.

Month.	Average number of cables operated.	Concrete material handled.			Time working.			Delays.				Total unit hours operated.	Average material handled per cable per hour working.	Per cent of hours working to hours operated.
		Concrete.	Large stone.	Cu. yds.	Handling concrete material.	Handling steel forms and filling.	Total.	Repairing.	Waiting on concrete.	Waiting on forms.	Moving towers.	Total delays.		
July.....	8	35,684	2,894	38,578	1,277.82	341.08	1,618.90	46.10	41.08	491.07	129.10	707.35	Cu. yds. 30.19	59.59
August.....	8	37,902	3,456	41,358	1,318.95	356.30	1,675.25	48.18	40.90	562.27	153.87	805.22	31.36	67.54
September.....	8	40,770	1,634	42,404	1,335.30	318.87	1,654.17	29.33	80.56	409.31	123.26	642.46	31.76	72.03
October.....	8	39,478	1,424	40,902	1,210.15	374.17	1,584.32	36.76	93.33	506.85	167.22	804.16	33.80	66.33
November.....	8	31,684	1,014	32,698	1,064.13	260.84	1,324.97	31.51	64.46	596.98	194.65	887.60	30.73	59.88
December.....	8	29,544	308	29,852	1,021.57	279.45	1,301.02	25.01	88.12	743.55	143.63	1,000.31	29.22	56.53
January.....	8	24,860	28	24,888	810.38	438.45	1,248.83	16.09	111.20	872.98	137.07	1,137.94	30.71	52.32
February.....	8	19,304	.....	19,304	555.78	344.04	899.82	17.98	188.51	510.71	99.52	816.72	34.73	52.42
March.....	8	21,512	.....	21,512	588.22	322.35	910.57	10.70	222.10	614.54	101.93	949.27	36.57	48.96
April.....	8	8,852	.....	8,852	276.26	496.30	772.56	12.85	224.59	656.03	120.64	1,014.11	32.04	43.24
May.....	8	5,711	.....	5,711	213.54	461.37	679.91	22.62	180.84	844.79	143.78	1,192.03	26.13	36.32
June.....	8	3,475	.....	3,475	163.43	521.11	684.54	24.42	105.98	844.19	117.98	1,092.57	21.26	38.52
Total.....	8	298,776	10,758	309,534	9,840.53	4,514.33	14,354.86	322.15	1,441.07	7,653.27	1,632.65	11,049.74	31.46	58.51
Percent of total.	.....	.....	.....	.....	38.74	17.77	56.51	1.27	5.08	30.12	6.42	43.49	.....	.....

Plant was operated 12 hours per day from July 1, 1911, to Jan. 31, 1912, and 9 hours per day from Feb. 1 to June 30, 1912. Quantities shown are bucket measurement.

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912—Continued.

TABLE 7.—Performance of Ancon quarry, fiscal year ended June 30, 1912.

[Plant consists of one No. 12 and four No. 6 crushers.]

PACIFIC DIVISION.

Month.	Crushed rock produced.	Crushing.	Delays.					Total unit hours operated per month.	Average quantity produced per hour.		Per cent of hours at work to hours operated.
			Repairing.	Crusher choked.	Waiting for stone.	Bins full, no cars.	Other delays.		Working time.	Total time.	
	<i>Cu. yds.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>		<i>Cu. yds.</i>	<i>Cu. yds.</i>	
July.....	61,362	167.91	2.09	12.23	4.81	12.67	25.29	225.00	365.45	272.72	74.63
August.....	58,962	169.02	14.67	6.92	32.08	10.42	9.89	243.00	348.85	242.64	69.56
September.....	63,426	179.70	2.33	12.34	10.18	5.76	14.69	225.00	352.95	281.89	79.87
October.....	64,446	184.67	16.41	17.00	10.66	1.50	6.76	237.00	348.98	271.92	77.92
November.....	60,430	170.00	3.92	7.61	24.12	6.59	3.76	216.00	355.47	279.77	78.70
December.....	66,101	184.34	6.56	4.27	17.41	2.33	10.09	225.00	358.58	293.78	81.93
January.....	59,043	168.93	27.77	3.40	18.33	4.42	11.15	234.00	349.51	252.32	72.19
February.....	51,081	146.08	16.16	7.18	29.48	9.66	7.44	216.00	349.68	236.49	67.63
March.....	99,523	303.52	71.06	10.09	65.74	12.18	5.41	468.00	327.90	212.66	64.85
April.....	82,770	235.82	13.42	7.50	61.10	5.50	9.66	333.00	350.99	248.56	70.82
May.....	102,302	289.99	34.23	3.66	65.08	42.35	32.69	468.00	380.12	218.59	61.96
June.....	68,462	183.80	4.50	.50	10.73	12.35	13.12	225.00	372.48	304.28	81.09
Total.....	837,908	2,383.78	213.12	92.70	349.72	125.73	149.95	3,315.00	351.50	252.76	71.91
Per cent of total.....	.....	71.91	6.43	2.80	10.55	3.79	4.52	100.00	.....	.....	.....

Plant was operated 9 hours per day from July 1, 1911, to Feb. 29, 1912; 18 hours per day from Mar. 1 to Mar. 31; 9 hours from Apr. 1 to 16; 18 hours from Apr. 17 to May 31, 1912, and nine hours from June 1 to June 30, 1912.

TABLE 8.—Performance of sand-unloading cranes, Balboa, fiscal year ended June 30, 1912.

[Plant consists of three electrically operated cranes.]
PACIFIC DIVISION.

Month.	Number of cranes operated.	Material handled.	Unload- ing.	Delays.				Total unit hours operated per month.	Rate per hour per crane.		Per cent of hours at work to hours operated.
				Repair- ing.	Waiting for barges.	Waiting for cars.	Other delays.		Working time.	Total time.	
		<i>Cu. yds.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>	<i>Hours.</i>		<i>Cu. yds.</i>	<i>Cu. yds.</i>	
July.....	2.00	33,914	255.00	.....	.....	143.00	.....	400.00	133.00	84.79	63.75
August.....	2.00	41,029	284.00	1.00	.....	142.00	2.00	432.00	144.47	94.97	65.74
September.....	1.96	39,863	260.50	8.50	.....	123.00	5.00	392.00	153.02	101.09	66.45
October.....	2.00	45,789	279.00	.....	.....	145.00	.....	432.00	164.12	105.99	64.58
November.....	2.00	35,803	234.00	.....	.....	150.00	.....	384.00	153.00	93.24	60.94
December.....	2.00	42,201	250.00	.....	.....	150.00	.....	400.00	168.80	105.50	62.50
January.....	2.00	50,287	304.00	.....	4.00	103.00	1.00	412.00	165.42	122.06	73.79
February.....	2.00	48,389	307.00	.....	.....	77.00	.....	384.00	157.61	126.01	79.95
March.....	2.00	51,138	322.00	.....	.....	94.00	.....	416.00	158.81	122.93	77.40
April.....	2.00	51,245	312.00	.....	.....	82.00	.....	394.00	164.25	130.06	79.19
May.....	2.00	65,641	376.00	10.00	8.00	31.00	.....	425.00	174.58	154.45	88.47
June.....	2.00	59,538	316.00	8.00	.....	69.00	8.00	401.00	188.41	148.47	78.80
Total.....	2.00	564,837	3,499.50	27.50	12.00	1,309.00	24.00	4,872.00	161.41	115.94	71.83
Per cent of total.....	.....	.....	71.83	.56	.25	26.87	.49	100.00	.....	.....	.....

Two cranes were operated 8 hours per day throughout the year, one being held in reserve.

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912—Continued.

TABLE 9.—Performance of auxiliary mixers (2-yard), Pedro Miguel locks, for fiscal year ended June 30, 1912.

[Plant consists of varying numbers of 2-cubic-yard mixers, moved from place to place as necessity arises.]

PACIFIC DIVISION.

Month.	Average number of mixers.	Concrete mixed.	Mixing.	Delays.					Total unit hours per day.	Mixed per hour.		Per cent of hours at work to hours operated.
				Repairs.	Waiting for material.	Waiting for forms.	Waiting for cars.	Other delays.		Working time.	Total time.	
		Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.		Cu. yds.	Cu. yds.	
July.....	2.96	16,333	420.00	21.00	5.50	39.00	168.50	12.00	666.00	38.89	24.52	63.06
August.....	3.00	15,896	445.50	8.50	13.00	57.50	202.50	2.00	729.00	35.68	21.81	61.11
September.....	2.76	13,088	367.00	.....	10.50	106.50	133.00	4.00	621.00	35.66	21.08	59.10
October.....	2.88	16,371	446.00	3.50	13.50	141.00	38.50	5.50	648.00	36.71	25.26	68.83
November.....	3.00	14,220	374.00	7.50	16.00	198.00	39.00	13.50	648.00	38.02	21.94	57.72
December.....	2.40	10,494	318.00	.....	24.00	168.00	15.00	15.00	540.00	33.00	19.43	58.89
January.....	2.00	10,122	306.42	1.50	55.58	96.50	.....	8.00	468.00	33.03	21.63	65.47
February.....	2.00	7,666	230.00	.....	18.00	183.50	.....	2.00	433.50	33.33	17.68	53.06
March.....	1.73	5,490	161.00	.....	38.00	195.50	.....	10.50	405.00	34.10	13.56	39.75
April.....	1.00	5,225	127.50	.....	19.75	73.25	.....	6.50	227.00	40.98	23.02	56.17
May.....	1.00	3,948	100.75	.....	12.00	119.25	.....	2.00	234.00	39.19	16.87	43.06
June.....	1.00	3,644	95.50	.....	11.25	115.50	.....	2.75	225.00	38.16	16.20	42.44
Total.....	2.14	122,497	3,391.67	42.00	237.08	1,493.50	596.50	83.75	5,844.50	36.12	20.96	58.03
Per cent of total.....	.....	.....	58.03	.72	4.06	25.55	10.21	1.43	100.00	.....	.....	.....

Quantities shown are bucket measurement.

TABLE 10.—Performance of chamber cranes, Pedro Miguel Locks, fiscal year ended June 30, 1912.

[Plant consists of four electrically operated cranes.]

PACIFIC DIVISION.

Month.	Average number of cranes.	Concrete placed.	Time working.			Delays.					Total unit hours operated per month.	Concrete handled per hour working.	Per cent of hours at work to hours operated.
			Placing concrete.	Handling steel, forms, filling, etc.	Total.	Repairs to cranes.	Waiting for concrete.	Waiting for forms.	Bridging.	Other delays.			
		Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.		Cu. yds.	
July.....	1.96	7,126	133.97	106.59	240.56	14.72	69.02	87.29	18.06	11.35	441.00	53.19	54.55
August.....	1.89	4,660	103.58	160.32	263.90	7.84	36.94	107.42	12.35	30.55	459.00	44.99	57.49
September.....	2.00	2,374	69.26	257.33	326.59	6.09	28.83	70.50	10.99	7.00	450.00	34.28	72.58
October.....	2.00	6,459	153.70	228.34	382.04	29.50	28.23	38.00	28.73	15.50	522.00	42.02	73.19
November.....	2.00	6,009	139.34	191.38	330.72	7.51	61.16	16.10	16.51	.....	432.00	43.12	76.56
December.....	1.08	1,116	52.58	110.83	163.41	9.42	31.75	46.67	17.34	64.41	333.00	21.22	49.07
January.....	1.00	706	17.25	93.49	110.74	12.25	5.58	1.08	39.41	137.68	306.74	40.93	36.10
Total.....	1.72	28,450	669.68	1,148.28	1,817.96	87.33	261.51	367.06	143.39	266.49	2,943.74	42.48	61.76
Per cent of total.....	.....	.....	22.75	39.01	61.76	2.97	8.88	12.47	4.87	9.05	100.00	.....	.....

The last crane working at this point ceased operation Jan. 29, 1912, preparatory to dismantling for removal to Miraflores. Quantities shown are bucket measurements. Plant was operated 9 hours per day during the period

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912—Continued.

TABLE 11.—*Performance of berm cranes, Miraflores Locks, fiscal year ended June 30, 1912.*

PACIFIC DIVISION.

[Plant consists of four electric cranes situated on berm of lock. Each crane is equipped with a battery of two 2-cubic yard mixers.]

Month.	Average number of—		Concrete mixed.	Time working.					Delays.					Total crane hours.	Mixer.		Average per mixer per hour.		Per cent of crane-work- ing time to total time under pay.
	Cranes.	Mixers.		Mixing and placing.	Handling forms, steel and other material.	Total.	Re- pairs to cranes.	Re- pairs to mix- ers.	Waiting for forms.	Bridg- ing.	Other delays.	Total delays.	Working time.		Total time.	Work- ing time.	Total time.	C. yds.		C. yds.
July.....	2.24	4.20	25,326	273.45	46.87	320.32	53.58	5.50	61.17	33.43	30.00	183.68	504.00	512.68	Hours.	Hours.	49.40	26.80	63.56
August.....	3.00	5.26	33,726	387.21	49.48	436.49	67.99	4.00	97.65	67.36	55.60	292.51	729.00	678.85	1,278.00	67.85	49.68	59.88	
September.....	2.88	5.28	25,349	309.07	22.68	331.75	44.94	3.00	158.84	62.87	46.60	316.25	648.00	566.70	1,183.00	566.70	44.73	21.34	51.20
October.....	3.04	5.85	26,200	367.09	27.92	395.01	45.64	1.00	148.34	75.17	45.84	315.99	711.00	706.28	1,308.00	706.28	37.10	19.15	55.56
November.....	4.00	7.00	19,427	373.50	61.00	434.50	45.25	2.50	262.75	78.55	40.45	429.50	864.00	653.62	1,512.00	653.62	29.72	12.85	50.29
December.....	4.00	6.64	31,180	560.15	72.70	632.85	47.69	6.92	136.32	62.19	63.03	316.15	949.00	929.85	1,575.34	929.85	33.53	19.79	66.69
January.....	4.00	6.31	37,054	592.76	119.98	712.74	42.00	4.18	147.36	73.26	83.46	350.26	1,063.00	971.54	1,742.25	971.54	38.14	21.27	67.05
February.....	4.00	7.83	47,120	643.15	58.07	703.22	42.41	7.00	116.41	66.04	48.92	280.78	984.00	1,262.56	1,925.69	1,262.56	37.32	24.47	71.47
March.....	4.00	8.00	49,584	670.50	49.95	720.45	41.26	2.01	62.23	88.31	144.74	338.55	1,059.00	1,341.00	2,118.00	1,341.00	36.98	23.41	68.03
April.....	4.00	8.00	47,630	641.17	33.44	694.61	38.14	.....	36.41	85.76	170.75	331.66	1,025.67	1,282.34	2,051.34	1,282.34	37.14	23.22	67.72
May.....	4.00	7.80	42,764	619.73	53.69	673.42	33.81	4.68	77.18	96.40	171.34	383.41	1,056.83	1,208.47	2,000.82	1,208.47	35.39	20.75	63.72
June.....	3.84	6.44	24,291	387.53	68.28	455.81	31.83	6.58	169.84	105.38	139.06	452.69	908.50	649.96	1,523.55	649.96	37.37	15.94	50.17
Total.....	3.58	6.55	409,651	5,827.31	683.86	6,511.17	534.45	47.37	1,474.50	894.72	1,039.79	3,990.83	10,502.00	10,703.85	19,287.99	10,703.85	38.06	21.24	62.00
Per cent of total.....	.....	.....	.....	55.49	6.51	62.00	5.09	.45	14.04	8.52	9.90	38.60	100.00	55.80	100.00	55.80	.....	.....	.....

Two cranes were operated from July 1 to 24, inclusive; the third crane was put in service July 25, and the fourth on Oct. 23, 1911. Quantities given are bucket measurement. Plant was operated 9 hours per day throughout the year, except in emergencies.

TABLE 12.—Performance of auxiliary mixers (2 yards), Miraflores Locks, for fiscal year ended June 30, 1912.

[Plant consists of two 2-cubic yard mixers located in openings left in east wall of upper lock.]

PACIFIC DIVISION.

Month.	Average number of mixers.	Concrete mixed.	Mixing.	Delays.						Total unit hours per day.	Mixed per hour.		Per cent of hours at work to hours operated.
				Repairs.	Waiting for material.	Waiting for forms.	Waiting for cars.	Other delays.	Total delays.		Working time.	Total time.	
		Cu. yds.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Hours.	Cu. yds.	Cu. yds.		
July.....	1.94	7,768	180.42	3.25	.....	.....	73.58	21.75	98.58	43.05	27.84	64.67	
August.....	2.00	23,512	373.80	7.30	4.83	.....	73.39	32.68	118.20	62.90	47.79	75.98	
September.....	2.00	27,874	379.73	4.77	8.05	3.00	31.92	41.53	89.27	73.40	59.43	80.97	
October.....	2.00	26,406	378.01	8.70	6.40	13.70	29.03	57.66	115.49	69.86	53.51	76.60	
November.....	1.83	15,536	228.60	17.00	6.80	43.60	89.70	34.30	191.40	67.96	36.99	54.43	
December.....	1.92	12,322	190.30	32.94	.94	.....	.....	234.82	268.70	64.75	26.85	41.46	
January.....	1.61	6,360	95.62	9.00	3.50	.....	.....	305.88	318.38	66.51	15.36	23.10	
February.....	2.00	9,682	151.92	13.66	2.17	47.50	.....	222.25	285.58	63.73	22.13	34.72	
March.....	2.00	20,404	312.99	11.16	6.01	1.75	.....	249.09	268.01	65.19	35.12	53.87	
April.....	2.00	30,596	448.68	8.80	.....	.....	.....	115.52	124.32	68.19	53.40	78.30	
May.....	2.88	36,486	554.13	37.24	.....	.....	.....	258.63	295.87	65.84	42.92	65.19	
June.....	2.88	36,504	526.65	45.97	.....	.....	.....	250.38	296.35	69.31	44.35	63.99	
Total.....	2.09	253,450	3,820.85	199.79	38.70	109.55	297.62	1,824.49	2,470.15	66.33	40.29	60.74	
Per cent of total.....			60.73	3.18	.62	1.74	4.73	29.00	39.27				

Commenced operation July 13. Quantities shown are bucket measurements.

EXHIBIT C.—PERFORMANCE OF ROCK, SAND, AND CONCRETE PRODUCING AND HANDLING PLANTS, FISCAL YEAR 1912—Continued.

TABLE 13.—Performance of chamber cranes, Miraflores Locks, fiscal year ended June 30, 1912.

[Plant consists of four electric cranes working in lock chambers.]

PACIFIC DIVISION.

Month.	Average number of cranes.	Material handled.		Time, working.			Delays.					Total unit hours operated per month.	Material handled per hour.		Per cent of hours at work to hours operated.
		Con-crete.	Back fill.	Placing material.	Hand-ling steel forms.	Total.	Repairs to cranes.	Waiting for concrete.	Waiting for forms.	Bridg-ing.	Other delays.		Work-ing time.	Total time.	
July	1.00	Cu. yds. 7,722	Cu. yds.	Hours. 122.90	Hours. 0.50	Hours. 123.40	Hours. 4.44	Hours. 11.99	Hours. 1.34	Hours. 1.83	Hours. 1.00	144.00	Cu. yds. 62.83	Cu. yds. 53.63	85.69
August	1.93	23,460	.....	404.78	6.82	411.60	28.45	17.78	6.75	9.42	.....	474.00	57.96	49.49	86.84
September	2.00	27,536	.....	413.69	1.87	415.56	14.93	34.83	.....	3.68	.....	469.00	66.56	58.71	88.61
October	2.00	24,486	.....	419.85	6.75	426.60	5.67	40.98	.....	1.50	2.00	493.50	58.32	49.62	86.44
November	1.92	14,782	.....	293.91	24.46	318.37	11.68	32.83	16.75	8.40	.....	437.00	50.29	33.83	72.85
December	1.96	10,698	.....	226.72	45.17	271.89	4.34	40.96	107.38	22.49	10.27	457.33	47.19	23.39	59.45
January	1.96	4,244	.....	105.74	160.90	266.64	.92	18.59	94.18	63.09	15.58	459.00	40.14	9.25	58.09
February	2.50	8,299	.....	192.76	76.51	269.27	3.67	57.56	174.66	28.34	6.50	540.00	43.05	15.37	49.86
March	3.20	18,024	.....	292.77	141.46	434.23	11.25	111.16	196.51	48.15	24.50	825.80	61.56	21.83	52.58
April	4.00	29,238	.....	481.93	96.97	578.90	33.42	182.74	189.49	30.19	27.76	1,042.50	60.67	28.05	55.53
May	3.90	32,904	.....	533.22	70.75	603.97	27.18	145.91	225.00	27.09	48.18	1,077.33	61.71	30.54	56.06
June	2.92	33,127	7,342	654.96	42.01	696.97	24.82	170.82	13.74	56.06	105.09	1,067.50	61.79	37.91	65.29
Total	2.48	234,520	7,342	4,143.23	674.17	4,817.40	170.77	866.15	1,091.52	300.24	240.88	7,486.96	58.38	32.30	64.34
Per cent of total	.....	.....	.....	55.34	9.00	64.34	7.28	11.57	14.58	4.01	3.22	100.00	.....	.....	.....

One crane began operations July 13, 1911; one, Aug. 3, 1911; one, Feb. 15, 1912; and the fourth, Mar. 26, 1912. Plant was operated 9 hours per day throughout the year, except in emergencies.

EXHIBIT D.—COMPARATIVE STATEMENT OF ADMINISTRATIVE AND GENERAL EXPENSES
FOR FISCAL YEAR 1911-12.

No.	Items.	Fiscal year—		Increase.	Decrease.
		1912	1911		
1	General administrative expenses.....	\$259, 194. 95	\$294, 085. 16	.....	\$34, 890. 21
2	Miscellaneous general expenses:				
3	On Isthmus.....	91, 851. 49	85, 801. 81	\$6, 049. 68	.....
4	Canal Record.....	18, 270. 04	18, 618. 48	.....	348. 44
5	Clubhouses.....	50, 565. 61	51, 193. 90	.....	628. 29
6	Isthmian Canal Commission band.....	12, 479. 14	12, 221. 40	257. 74	.....
7	In the United States.....	96, 767. 10	88, 408. 55	8, 358. 55	.....
8	Disbursing officers:				
9	On Isthmus.....	72, 968. 32	74, 546. 95	.....	1, 578. 63
10	In the United States.....	34, 048. 69	33, 492. 63	556. 06	.....
11	Examiners of accounts:				
12	On Isthmus.....	159, 470. 05	172, 917. 14	.....	13, 447. 09
13	In the United States.....	12, 021. 02	11, 759. 45	261. 57	.....
14	Transportation on Isthmus (passenger).....	109, 287. 90	123, 238. 38	.....	13, 950. 48
15	Telegraph and telephones.....	143, 634. 64	151, 072. 27	.....	7, 437. 63
16	Purchasing expenses in United States:				
17	Purchasing expenses, general.....	169, 853. 60	154, 593. 23	15, 260. 37	.....
18	Lock gates, inspection.....	51, 721. 10	31, 902. 32	19, 818. 78	.....
19	Locks, operating machinery—inspection..	48, 163. 02	3, 947. 44	44, 215. 58	.....
20	Emergency dams, inspection.....	42, 382. 24	3, 327. 52	39, 054. 72	.....
21	Spillway gates and machinery, inspection.	4, 009. 02	4, 072. 68	.....	63. 66
22	Hotel equipment.....	.....	21, 330. 53	.....	21, 330. 53
23	Hotel, incidental expenses.....	.....	22, 559. 18	.....	22, 559. 18
24	Operation of stores.....	462, 031. 90	496, 312. 83	.....	34, 280. 93
25	Recruiting and repatriating.....	65, 915. 45	71, 368. 88	.....	5, 453. 43
26	Quarters.....	415, 636. 75	480, 495. 95	.....	64, 859. 20
27	Construction of buildings, department of construction and engineering.....	1, 775. 96	7, 420. 94	.....	5, 644. 98
28	Repairs to buildings, department of construction and engineering.....	7, 552. 41	7, 808. 59	.....	256. 18
29	Clubhouse equipment.....	.....	9, 294. 56	.....	9, 294. 56
30	Operation docks and wharves, Isthmian Canal Commission.....	19, 862. 68	82, 730. 51	.....	62, 867. 83
31	Operation docks and wharves, Panama R. R.	23, 969. 98	22, 884. 61	1, 085. 37	.....
32	Total.....	2, 373, 433. 06	2, 537, 405. 89	.....	163, 972. 83

NOTE.—Item 18, hotel equipment; item 19, hotel incidental expenses. These expenditures are now carried under "general items," and amounted to \$19,047.50 and \$19,164.10, respectively.

EXHIBIT E.—STATEMENT OF SALARY DISBURSEMENTS, BY DEPARTMENTS AND DIVISIONS AND BY APPROPRIATIONS, FOR THE FISCAL YEAR ENDED JUNE 30, 1912.

Department or division.	Officers and employees.		Skilled and unskilled labor.		Total pay rolls.
	Amount.	Per cent of total.	Amount.	Per cent of total.	
Chairman and chief engineer.....	\$394,838.77	71.54	\$157,054.65	28.46	\$551,893.42
Atlantic division.....	897,721.05	20.69	3,440,714.09	79.31	4,338,435.14
Central division.....	730,359.28	14.81	4,200,816.54	85.19	4,931,175.82
Pacific division.....	604,607.38	15.92	3,193,022.26	84.08	3,797,629.64
Mechanical division.....	243,816.02	11.52	1,873,192.41	88.48	2,117,008.43
Quartermaster's department.....	423,902.04	32.39	884,763.57	67.61	1,308,665.61
Subsistence department.....	78,192.35	38.24	126,281.79	61.76	204,474.14
Examiner of accounts.....	170,921.76	100.00	.....	.....	170,921.76
Disbursing officer.....	65,414.67	100.00	.....	.....	65,414.67
Personal-injury claims.....	21,260.70	11.32	166,506.28	88.68	187,766.98
Total, construction and engineering.....	3,631,034.02	20.55	14,042,351.59	79.45	17,673,385.61
Sanitary department.....	693,671.24	77.46	201,872.35	22.54	895,543.59
Personal-injury claims.....	237.08	62.44	142.59	37.56	379.67
Total, sanitary department.....	693,908.32	77.45	202,014.94	22.55	895,923.26
Department of civil administration.....	616,837.39	96.18	24,475.50	3.82	641,312.89
Personal-injury claims.....	1,890.62	97.43	49.92	2.57	1,940.54
Total, department of civil administration.....	618,728.01	96.19	24,525.42	3.81	643,253.43
Total, all departments.....	4,943,670.35	25.73	14,268,891.95	74.27	19,212,562.30

EXHIBIT F.—CONSTRUCTION OF PANAMA RAILROAD CO. DOCK AT BALBOA—TOTAL COST TO JUNE 30, 1912.

	Quantity of work done.	Amount.	Unit cost.
Dredging:	<i>Cu. yds.</i>		
Clearing for dredges.....	923,477	\$624.59	\$0.0007
Seagoing suction dredge—			
Operation.....	83,562	3,654.69	.0437
Repairs.....	83,562	1,427.85	.0171
Ladder dredges—			
Operation.....	922,421	26,877.62	.0291
Repairs.....	922,421	11,680.11	.0126
Tugs, clapsnets, and scows—			
Operation.....	922,421	50,657.98	.0549
Repairs.....	922,421	22,658.63	.0246
Small boats—			
Operation.....	1,005,983	3,632.67	.0036
Repairs.....	1,005,983	4,212.86	.0042
Maintenance of miscellaneous equipment.....	1,005,983	372.06	.0004
Division expense.....	1,005,983	5,888.19	.0059
Total.....	1,005,983	131,687.25	.1309
Back filling:			
Excavation by steam shovel.....		804.55	.....
Transportation.....		73.42	.....
Filling.....		538.31	.....
Division expense.....		113.59	.....
Total.....		1,529.87	.....
Excavation for piers:			
Excavation by hand.....	7,197	18,543.03	2.5765
Excavation by orange-peel bucket.....	15,469	5,589.15	.3613
Disposal of waste.....	22,666	12,187.73	.5377
Pumping.....	22,666	8,008.69	.3533
Maintenance of equipment.....	22,666	9,765.66	.4309
Preliminary and general work.....	22,666	8,604.07	.3796
Plant, arbitrary.....	22,666	4,229.67	.1866
Division expense.....	22,666	3,497.66	.1543
Total.....	22,666	70,425.66	3.1071

EXHIBIT F.—CONSTRUCTION OF PANAMA RAILROAD CO. DOCK AT BALBOA—TOTAL
COST TO JUNE 30, 1912—Continued.

	Quantity of work done.	Amount.	Unit cost.
Concrete substructure:	<i>Cu. yds.</i>		
Wood forms in place.....	6,341	\$2,179.94	\$0.3434
Steel forms in place.....	6,341	5,354.48	.8444
Cement.....	6,341	10,991.26	1.7334
Rock.....	6,341	6,769.51	1.0676
Sand.....	6,341	2,866.90	.4522
Mixing.....	6,341	8,385.21	1.3224
Placing.....	6,341	9,132.87	1.4403
Reenforcements.....	6,341	30,035.50	4.7365
Large rock.....	6,341	441.31	.0696
Maintenance of equipment.....	6,341	4,062.05	.6406
Preliminary and general work.....	6,341	5,234.89	.8256
Plant, arbitrary.....	6,341	2,348.01	.3703
Division expense.....	6,341	2,947.72	.4649
Total.....	6,341	90,749.65	14.3116
Ironwork in dock:			
Placing and adjusting.....		2,089.04	
Division expense.....		53.56	
Total.....		2,142.60	
Concrete superstructure:			
Wood forms in place.....	2,353	17,633.41	7.4941
Steel forms in place.....	2,353	117.61	.0500
Cement.....	2,353	5,301.41	2.2531
Rock.....	2,353	1,688.57	.7176
Sand.....	2,353	1,122.02	.4768
Mixing.....	2,353	3,414.48	1.4511
Placing.....	2,353	1,820.20	.7736
Reenforcements.....	2,353	6,333.41	2.6916
Maintenance of equipment.....	2,353	1,116.58	.4745
Preliminary and general work.....	2,353	1,761.94	.7488
Plant, arbitrary.....	2,353	1,056.80	.4491
Division expense.....	2,353	1,195.26	.5080
Total.....	2,353	42,561.69	18.0883
Fenders:			
Installation.....		2,528.19	
Division expense.....		28.00	
Total.....		2,556.19	
Anchorage:			
Excavation for anchors.....	948	4,811.46	4.8897
Concrete.....	64	1,891.93	29.5614
Iron.....		2,398.48	
Plant, arbitrary.....		673.97	
Division expense.....		312.64	
Total.....		10,083.48	
Total cost.....		351,741.39	

APPENDIX J.

REPORT OF LIEUT. COL. C. A. DEVOL, QUARTERMASTER'S DEPARTMENT, UNITED STATES ARMY, CHIEF QUARTERMASTER, IN CHARGE OF QUARTERMASTER'S DEPARTMENT.

ISTHMIAN CANAL COMMISSION,
QUARTERMASTER'S DEPARTMENT,
Culebra, Canal Zone, July 1, 1912.

SIR: I have the honor to submit the following report of the operation of the quartermaster's department for the fiscal year ending June 30, 1912:

No change in the organization of the quartermaster's department has been made during the year, and the duties performed are identical with those previously reported.

The following changes in personnel were made:

Miraflores storehouse: C. A. Gilmartin, storekeeper, vice Robert Wuerz, resigned.

Gatun storehouse: Vesper C. Dillon, storekeeper, vice C. R. Bryon, resigned.

Las Cascadas-Bas Obispo district: Harry Dundas, district quartermaster, vice John M. King, resigned.

The work of the department has not diminished; the number of employees and their families quartered and cared for is equal to that of previous years. The value of supplies received and distributed was greater than in any previous year. There has nevertheless been a decrease in the cost of operation as shown by the following figures:

	1909-10	1910-11	1911-12
Work of the quartermaster's department, proper.....	\$1,513,210.40	\$1,182,728.01	\$951,934.39
Work performed for other departments.....	684,059.45	663,318.18	793,057.91
Total.....	2,197,269.85	1,846,046.19	1,744,992.30

LABOR.

The force on the Isthmus has fluctuated during the year, as shown below:

Panama Railroad and Isthmian Canal Commission:

	Men.
June 30, 1911.....	32,690
January 10, 1912.....	38,515
June 30, 1912.....	34,957

In March, 1910, the highest recorded force was shown as 38,676. It will be noted that the force in January, 1912, is only 161 short of the high figure. Since January there has been a reduction of 3,600

men but the end of this fiscal year shows a force larger by over 2,000 than at the end of the fiscal year 1911. An analysis of the figures of June 30, 1911, and of June 30, 1912, show that while there has been a decrease of approximately 2,900 men in the Atlantic division and relocation, this has been more than offset by increases in the Panama Railroad, Pacific division, First division of the chief engineer's office and fortification.

Immigration to the Isthmus has continued to decrease, the excess of arrivals over departure for the year amounting to but 3,510. To meet a demand for unskilled labor, at the beginning of the fiscal year, the department was obliged to bring in 941 men, recruited by our agent at Barbados from the small islands adjacent.

This undoubtedly marks the last shipment of unskilled labor to the canal. Altogether 44,394 laborers have been brought to the Isthmus by the Commission, of which 11,697 have been brought from Europe and 19,448 from the island of Barbados. The balance were brought from other West Indian islands and from Colombia.

The supply and demand for labor is about balanced at the date of this report. When labor becomes surplus it is hoped the adjacent countries will absorb the surplus as it is presumed the reduction in force will be gradual. During the past three months 1,339 laborers have been taken over by the United Fruit Co. to work in Guatemala.

QUARTERS.

The Tabernilla-San Pablo district was abandoned, this district being entirely in the lake area.

Work on the Balboa terminals began June 1, and the demolition of the settlement of Old Balboa is in progress.

The laborers' camp at White House and other buildings in the Las Cascadas district were altered and repaired as quarters for the Tenth Infantry, United States Army. This regiment was provided for on the Isthmus at an expense of \$50,000, payable from the appropriation "Barracks and Quarters," United States Army.

Quarters were opened up at Naos Island and Margarita Point to take care of the forces on the fortification work, over 500 laborers now being quartered at Naos Island.

An analysis of the census of occupants of quarters shows a decrease of 300 in the number of Americans and an increase of 700 in the number of West Indians in quarters. The number of Europeans remains constant. Two hundred and ten of the Americans quartered are employees of the McClintic-Marshall Construction Co.

The census of quarters also shows that of the commission employees occupying quarters 48 per cent of the married men and but 20 per cent of the bachelors were men hired prior to 1908.

With the increased work on the Pacific side there has been an increased demand for quarters in all districts, Ancon to Pedro Miguel inclusive. All gold and silver quarters are filled to capacity in these districts. Congestion has been obviated by the removal and reerection of American-built houses from Tabernilla, San Pablo, Gatun spillway camp, Empire, and Culebra. There has been no diminution in the demand for married quarters, the number of applications on file as of June 30 being 697, or 54 more than a year ago.

ZONE SANITATION.

In accordance with the recommendations of a board, approved by the chairman, the grass-cutting areas in the various districts have been platted and measured and regulations compiled for sanitary inspectors and district quartermasters with reference to the method of handling work performed by the quartermaster's department for the sanitary department.

The amount allotted by the sanitary department to cover the cost of work performed by the quartermaster's department during the fiscal year was \$288,000. The amount expended by this department to perform this work was \$251,768—a saving of \$36,232. The cost of sanitary work for the past three years shows a progressive decrease, as follows:

	1909-10	1910-11	1911-12
Sanitation proper.....	\$233,693.00	\$210,403.29	\$180,675.67
Hospitals, quarantine, etc.....	97,139.81	77,284.48	71,092.40
Total.....	330,832.81	287,687.77	251,768.07

CORRALS.

The character and amount of work has remained about the same. Delivery service is furnished to the Tenth Infantry. Horse mowing machines are being used in all districts, and the work of the sanitary department consequently requires more teams. Approximately 25 per cent of public animals are used on sanitary department work.

Twenty-four horses and mules have been condemned and destroyed, 10 condemned and sold, 6 killed, and 8 died, a total of 48. The loss from disease has been smaller than for a number of years.

No animals have been purchased for over three years, and the public animals in the quartermaster's department average more than six years' service. They are in excellent condition notwithstanding.

BUILDING CONSTRUCTION.

There were but 22 new buildings constructed during the fiscal year. Most of these were small, the total cost of construction for the 22 being \$26,000. The only new buildings costing over \$1,000 were the fire station at Cristobal, the caretaker's house at Brazos Brook, and a type 27 at Toro Point, these three buildings costing \$21,000. The fire station and the caretaker's residence are permanent structures of concrete.

Eighteen additions to existing buildings were made, at a cost of \$71,000. Of this, \$63,000 represents alterations and additions to the Hotel Tivoli.

Thirty-six buildings were taken down in sections and moved to new locations, at a cost of \$58,000. Fifteen buildings were demolished, material moved to other points and used in construction of 13 buildings, costing \$26,790.30. Of the above, 14 buildings were moved from Culebra on account of slides, and 25 buildings from Tabernilla and San Pablo on account of the flooding of the lake area.

The removal and reerection of American buildings, still good but useless in their old locations, accounts for the small amount of new

construction. This has been a decided saving to the Government. The traveling gangs of the construction quartermaster move and reerect these buildings at an average of 30 per cent of the original cost of the buildings to the commission. The total number of buildings moved since July, 1909, is 133, of which 95 have been taken down in sections, moved, and reerected. The cost of repair work has decreased as follows:

	1910-11	1911-12
Repair work, quartermaster's department.....	\$156,797.48	\$120,912.21
Repair work, sanitary department, department of civil administration and divisions.....	38,497.58	47,392.31
Total.....	195,295.06	168,304.52

During the year, besides the 22 new buildings erected, 22 buildings were acquired from the Pacific Mail Steamship Co. at Naos Island. One hundred and forty-nine old French buildings were sold, realizing \$8,000. One hundred and thirty-one buildings were demolished, a total loss of 280 buildings. Most of the buildings sold were small sheds. There was a net decrease of 236 buildings. Of the 2,148 buildings turned over by the French in 1904, but 850 remain.

SCRAP.

On September 26, 1911, a contract was entered into with the Chicago House Wrecking Co. by which they purchased all French scrap on the Isthmus as it lies, for a consideration of \$215,000. This company is now collecting and breaking up this scrap. They have approximately 10,000 tons at Cristobal ready for shipment.

Seven thousand and five tons of American scrap were received at Mount Hope during the year, of which 4,603 tons came from Empire and Gorgona shops; 1,892 tons were shipped to the States and sold in New York at an average price of \$10.35 per ton, the net price realized being about \$5 per ton. A contract has been entered into with the Chicago House Wrecking Co. by which all American scrap now on hand and to be accumulated, which is not needed by the Panama Railroad Co. and Isthmian Canal Commission, is to be sold to this company at a price of \$10.52 per ton, f. o. b. Colon.

Sales of scrap screening, rope, rubber belting, hose, and rubber continued through the year. Messrs. R. Rosenberg & Sons Co. were awarded a contract for this material at the following unit prices:

	Per cwt.
Screening.....	\$8.25
Rope.....	2.18
Rubber.....	2.10
Hose.....	2.50

Sale of this scrap for the ensuing year is now being advertised.

Practically all iron and steel material that can be classed as scrap, now on hand or that will be accumulated, has been disposed of at terms that are advantageous to the commission. The commission is holding approximately 750,000 pounds of American copper and brass scrap.

Sale of scrap to date is summarized as follows:

	Quantity.	Average selling price.	Amount realized.	
			Gross.	Net.
French scrap (16,243 long tons), and American scrap (14,188 long tons).	30,431 long tons.	\$11.91 per ton...	\$362,372.26	\$188,453.69
Screening.....	269,476 pounds..	\$7.82 per cwt....	21,085.03	17,656.91
Rope.....	138,249 pounds..	\$2.16 per cwt....	2,985.20	2,639.92
Belting.....	1,216 pounds....	\$0.54 per cwt....	6.51	3.41
Rubber.....	114,874 pounds..	\$2.08 per cwt....	2,385.11	2,089.36
Hose.....	286,772 pounds..	\$2.48 per cwt....	7,116.07	6,138.93
Total.....				216,982.25

PLANT AND EQUIPMENT.

So far but little of the commission's plant has been retired. There is maintained by the quartermaster's department a list, by units, of all plant and equipment. This list was inaugurated October 1, 1911, and is now being completed and brought up to date, giving the equipment acquired from the French Canal Co. separately from that purchased by the United States. This list has been brought down to the close of the fiscal year 1912 and shows original cost, date of purchase, from whom purchased, and physical condition June 30, 1912. From this data catalogues can be prepared from time to time when the plant units become surplus and are offered for sale. The Secretary of the Interior was furnished a list on February 25, 1912, of equipment in service of the Isthmian Canal Commission, suitable for railroad construction work, with approximate dates of release from the service here.

Material to the value of \$193,313.34 has been surveyed and turned into the storehouse for obsolete material during the year, the amount remaining on hand at price-book prices being \$369,000. The quantity was such that additional facilities had to be provided by constructing an addition to the storehouse for obsolete material. Material to the value of \$21,704.65 was reissued and \$10,708.94 was disposed of by local sales from the storehouse for obsolete material.

Much of the material and equipment in the storehouse for obsolete material was catalogued and advertised for sale in February, 1912. The bids on 18 classes were rejected and awards to the sum of \$20,858 were made on 8 classes. A portion of the steel-lock forms used at Gatun sold for \$6,758.

A portion of the plant will probably be retired during the coming fiscal year. It is hoped that some large construction job may be found that will utilize both men and material from the Isthmus. Sale of plant to scrap dealers will necessarily involve a risk to them and a wait for their money, and they will bid accordingly. An evidence of this was the bid of 10 per cent on original valuation of steam shovels offered for sale. It is therefore believed a successful disposition of the surplus plant at the end of the work will depend upon the inauguration of some similar work elsewhere.

MATERIAL AND SUPPLIES.

The policy of stock reduction has been continued throughout the year.

Comparatively few annual contracts were let this spring, as, with the end of the work in sight, it becomes necessary to place increased

dependence on emergency orders. On certain classes of stock heretofore covered by annual contracts, prospective requirements are so small that they can be better covered by requisitions placed when needed.

The quantity and value of supplies from the United States during the fiscal year were both larger than for any previous year at canal work; 504,004 tons of material to the value of \$10,517,260.99 were received. This tonnage does not include the piling nor the material for the McClintic-Marshall Construction Co. and the values do not include \$1,528,447 paid to the McClintic-Marshall Construction Co., account of material received on their contract. There was a decrease in the cement receipts, but an increase in the amount of piling and an increase of over 4,000,000 feet, board measure, in the lumber receipts. Prices on lumber and piling were considerably higher than in previous years.

Eighty-eight thousand six hundred and seven tons of material for the Isthmian Canal Commission, besides 1,338 tons for the Panama Railroad and private individuals, were handled over dock 14 by the depot quartermaster. The cost of handling was \$21,471.96, or \$8,180 less than at the tariff formerly charged by the Panama Railroad. A new dock at Mindi was completed and dynamite ships are berthed there. Due to the congested conditions at the Panama Railroad dock at Balboa, delays were experienced berthing and discharging vessels bringing lumber from the Pacific coast, but the completion of the new lumber dock at Balboa should obviate this in future.

A large amount of material has been recovered from the work and returned to stock. The Central and Atlantic divisions and the relocation, part of whose work has been completed, have turned in material to the value of \$680,000. Clean-ups of repair shops, etc., were made, and repair parts, fittings, and miscellaneous material were turned in in large quantities. Nevertheless the storehouses have absorbed this material and have shown an absolute reduction in stock of \$790,568.50. The following statement shows the actual total reduction:

Stock on hand June 30, 1911.....	\$4, 511, 781. 46
Material returned to stock by outside divisions.....	862, 400. 78
	5, 374, 182. 24
Stock on hand June 30, 1912.....	3, 721, 212. 90
Reduction.....	1, 652, 969. 34

Every storehouse, with the exception of Ancon and Toro Point, show a decrease in stock carried. The depot and the two largest storehouses (Empire and Gorgona) show the following decreases:

Mount Hope.....	\$138, 958. 44
Gorgona.....	196, 323. 63
Empire.....	162, 984. 87

Exhibit No. 16, appended, gives the value of the different classes of material carried in stock, as shown by the inventories of 1911 and 1912. Of the 43 classes of material covered, 33 show a stock reduction. Class 43, miscellaneous material carried for the entire work, shows the greatest absolute and relative reduction, viz, \$637,000, or over 25 per cent.

The repair parts do not make as good a showing, although in some classes, notably air-brake material, car parts, locomotive parts, dredge parts, and drill parts, the stock has been materially reduced.

There has been a reduction of \$77,000 in the amount of steam-shovel parts, but the value of this class of stock remains over \$300,000 and there is little prospect of working it off before the end of the work. The same holds true of the stock of inspirators and injectors; the special electrical material on hand at Gatun store, the stock of Lidgerwood unloader, spreader, and cableway repair parts.

A large amount of track material was salvaged during the year—the material from the old main line of the Panama Railroad between Gatun and Gorgona, the central division tracks in the Bohio-Tabernilla-San Pablo districts, and some trackage from the relocation. Over \$200,000 worth was turned in to Mount Hope and Empire, of which \$118,000 worth has been reissued.

The retail business of the department, viz, issues from line storehouses, has amounted to \$8,266,278.23, and the percentage of operating expenses to issues is 2.52 per cent.

Mount Hope invoiced material to the amount of \$9,483,033 to departments and divisions and issued for stock to line storehouses approximately \$4,550,000.58. There has been issued and sold to the Tenth Infantry, Marine Corps, and Navy Department material of the value of \$21,000.

Dead stock has been cleaned up and turned in to the amount of \$480,000. The material on hand in line storehouses now represents active stock, with the exception of the repair parts above mentioned, which can not be worked off.

The depot quartermaster and line storekeepers deserve much credit for their efforts toward stock reduction. They have made every effort to place surplus stock where it could be used to advantage.

The approaching completion of the work complicates the situation in regard to material, as it daily leaves a shorter margin of time in which to dispose of stock. On the other hand, the work still demands over \$12,000,000 of material annually, and construction work is progressing at a rate of speed that will permit no delay in supply. It will be impossible, therefore, to come to a full stop with nothing on hand, but an endeavor is being made to make the amount as small as is consistent with wise economy.

Respectfully,

C. A. DEVOL,
Chief Quartermaster.

Col. GEORGE W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

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- Exhibit 1. Force actually at work June 30, 1912.
 - Exhibit 2. Statement showing force at work for the Isthmian Canal Commission and Panama Railroad Co., 1906–1912.
 - Exhibit 3. Occupants of commission quarters, June 30, 1912.
 - Exhibit 4. Applications for married quarters on file, June 30, 1912.
 - Exhibit 5. Animals in commission corrals, June 30, 1912.
 - Exhibit 6. Number of buildings on the Canal Zone, June 30, 1912.
 - Exhibit 7. Buildings constructed, fiscal year 1911–12.
 - Exhibit 8. Buildings sold and demolished, fiscal year 1911–12.
 - Exhibit 9. Value of material received during fiscal year 1911–12.
 - Exhibit 10. Freight statement, fiscal year 1911–12.
 - Exhibit 11. Important items due on United States requisitions.
 - Exhibit 12. Important items of material purchased from inception of work.
 - Exhibit 13. Important items of material received, 1911–12.
 - Exhibit 14. Values of stock on hand at storehouses.
 - Exhibit 15. Classification of material in stock at storehouses.
 - Exhibit 16. Material returned to stock by departments and divisions.

EXHIBIT 1.—*Force actually at work June 30, 1912.*

Department or division.	Monthly.	Silver employees.										Total.		Grand total.			
		Artisans.				Laborers.											
		44 cents.	32 cents.	25 cents.	20 cents.	16 cents.	Europeans.		20 cents.	16 cents.	13 cents.	10 cents.	7 cents.		5 cents.	Silver.	Gold.
							20 cents.	16 cents.									
Construction and engineering.....	4,318	10	12	235	730	2,841	3,751	538	114	430	4,120	2,764	20,116	3,046	23,162		
Civil administration.....	186			2	3	24						10	225	355	580		
Department of sanitation.....	673			3	3	5			1	1	6	325	1,019	358	1,377		
Quartermaster's department.....	911			101	125	237	60	22	30		189	738	2,422	203	2,625		
Subsistence department.....	648			2		1							651	54	705		
Disbursing officer.....	7												7	32	39		
Examiner of accounts.....	4												4	84	88		
Total.....	6,747	10	12	343	861	3,108	3,811	360	145	431	4,315	3,837	24,444	4,125	28,569		
Commissary department, Panama R. R.....	650			4	14	75					29	200	1,062	265	1,327		
Panama R. R. Co.....													4,054	539	4,593		
Panama R. R. relocation.....													457	11	468		
Total.....	650			4	14	75					29	200	5,573	815	6,388		
Grand total.....	7,397	10	12	347	875	3,183	3,811	360	145	431	4,344	4,037	30,017	4,940	34,957		

EXHIBIT 2.—Statement showing force at work for the Isthmian Canal Commission and Panama R. R. Co. from December, 1906, to June, 1912.

Year and month.	Commission.			Total.		Laborers.			
	Gold.	Silver.	Total.	Pan-ama R. R.	Pan-ama R. R. and commiss-ion.	Europeans.		Colored.	
						20 cents.	16 cents.	13 cents.	10 cents.
1906. ¹									
December.....	3,881	15,604	19,485	4,416	23,901	1,591	706	211	6,430
1907. ¹									
January.....	4,033	16,987	21,020	4,796	25,816	1,985	447	213	7,017
February.....	4,357	18,680	23,037	4,575	27,612	2,380	442	251	7,227
March.....	4,411	19,708	24,119	5,249	29,368	2,993	332	282	7,285
April.....	4,570	19,697	24,267	5,475	29,742	3,106	467	374	6,715
May.....	4,465	20,105	24,570	4,892	29,462	3,908	411	492	6,281
June.....	4,404	18,923	23,327	6,119	29,446	3,929	388	205	5,216
July.....	4,529	19,632	24,161	6,192	30,353	3,980	419	281	4,824
August.....	4,546	19,487	24,033	5,834	29,867	4,056	428	309	4,347
September.....	4,638	18,969	23,607	6,238	29,845	4,374	218	515	3,749
October.....	4,992	20,836	25,828	6,139	31,967	4,839	295	770	4,031
November.....	4,822	20,507	25,329	6,148	31,477	4,764	292	806	3,663
December.....	4,668	19,095	23,763	4,940	28,703	4,518	275	852	3,689
1908. ¹									
January.....	4,935	20,493	25,428	6,557	31,985	4,978	276	905	3,748
February.....	5,083	20,745	25,828	6,430	32,258	5,016	472	728	3,643
March.....	4,996	20,556	25,552	7,103	32,655	4,897	510	692	3,677
April.....	4,950	21,168	26,118	7,052	33,170	4,773	593	729	3,738
May.....	4,745	31,036	25,881	7,052	32,933	4,400	562	684	4,139
June.....	4,587	20,991	25,578	5,622	31,200	4,413	500	537	4,616
July.....	4,477	21,049	25,526	5,794	31,320	4,187	558	516	4,344
August.....	4,396	21,486	25,882	5,794	31,676	4,505	411	1,374	4,566
September.....	4,328	21,129	25,457	5,132	30,589	4,865	377	1,263	4,103
October.....	4,183	20,752	24,935	5,766	30,701	5,793	327	1,343	4,004
November.....	4,161	19,803	23,964	5,863	29,827	4,422	368	1,593	3,854
December.....	4,275	20,142	24,417	6,091	30,508	4,617	188	2,010	3,682
1909. ¹									
January.....	4,295	20,583	24,878	6,393	31,271	4,693	220	2,335	3,560
February.....	4,334	20,858	25,192	6,623	31,815	4,720	265	1,969	3,315
March.....	4,381	21,352	25,733	7,263	32,996	4,690	478	1,923	3,124
April.....	4,355	22,480	26,835	6,864	33,699	4,100	510	5,740	3,229
May.....	4,262	22,032	26,294	6,365	32,659	3,817	359	2,664	5,646
June.....	4,166	22,302	26,468	6,472	32,940	3,672	475	1,797	5,370
July.....	4,198	22,740	26,938	6,963	33,901	3,591	485	2,005	5,558
August.....	4,070	22,449	25,519	7,223	33,742	3,446	530	2,681	5,793
September.....	4,191	23,158	27,349	7,861	35,210	3,442	544	2,577	6,009
October.....	4,376	23,411	27,787	7,618	35,405	3,366	661	2,906	5,754
November.....	4,372	22,014	26,386	7,422	33,808	3,100	704	2,786	5,167
December.....	4,339	22,905	27,244	6,701	33,945	3,398	1,113	4,036	5,113
1910. ¹									
January.....	4,532	25,218	29,750	7,636	37,386	3,641	1,221	4,289	5,579
February.....	4,602	25,212	29,814	7,644	37,458	3,451	1,135	4,452	5,420
March.....	4,553	26,284	30,837	7,839	38,676	3,710	1,553	4,587	5,195
April.....	4,465	24,726	29,191	7,692	36,903	3,652	1,596	4,054	4,878
May.....	4,368	25,192	29,560	7,236	36,796	3,669	1,936	3,678	5,287
June.....	4,367	24,717	29,084	6,494	35,578	3,354	1,986	3,675	5,187
July.....	4,389	25,372	29,901	6,549	36,450	3,506	2,056	3,793	5,714
August.....	4,445	25,505	29,950	5,917	35,867	3,535	1,960	3,850	5,694
September.....	4,439	25,229	29,668	5,681	35,369	3,411	1,679	4,042	5,485
October.....	4,596	25,097	29,693	5,641	35,334	3,409	1,611	3,273	5,067
November.....	4,646	25,044	29,690	5,960	35,650	3,296	1,525	3,358	5,126
December.....	4,705	24,383	29,088	6,044	35,142	3,311	1,440	3,229	4,972

¹ Panama R. R. includes Panama R. R. and commissary.

EXHIBIT 2.—Statement showing force at work for the Isthmian Canal Commission and Panama R. R. Co. from December, 1906, to June, 1912—Continued.

Year and month.	Commission.			Total.		Laborers.			
	Gold.	Silver.	Total.	Panama R. R.	Panama R. R. and commission.	Europeans.		Colored.	
						20 cents.	16 cents.	13 cents.	10 cents.
1911. ¹									
January.....	4,875	24,967	29,842	7,429	37,271	3,443	1,300	3,576	4,847
February.....	4,821	23,729	28,550	6,916	35,466	3,190	1,166	3,499	4,123
March.....	4,718	24,132	28,850	6,956	35,806	3,344	1,282	3,583	4,343
April.....	4,540	23,592	28,132	7,127	35,259	3,125	1,172	3,883	4,088
May.....	4,345	23,347	27,692	7,104	34,796	2,992	1,031	3,981	4,135
June.....	4,292	21,795	26,087	6,603	32,690	2,958	876	3,752	3,575
July.....	4,250	23,490	27,740	6,941	34,681	3,926	100	4,787	4,168
August.....	4,141	24,731	28,872	6,776	35,648	4,297	44	5,137	4,679
September.....	4,112	25,511	29,623	7,692	37,315	4,575	42	5,113	4,985
October.....	4,229	25,312	29,541	7,728	37,269	4,425	446	4,997	4,546
November.....	4,279	25,504	29,783	7,807	37,590	4,200	591	5,219	4,482
December.....	4,420	25,439	29,859	7,967	37,826	4,075	755	5,421	4,109
1912. ¹									
January.....	4,332	25,818	30,150	8,024	38,174	4,037	754	5,643	4,118
February.....	4,500	26,345	30,845	6,796	37,641	4,159	765	5,910	4,080
March.....	4,338	25,746	30,084	5,973	36,057	4,149	686	6,881	3,895
April.....	4,276	25,078	29,354	6,782	36,136	4,024	506	5,474	3,891
May.....	4,129	24,143	28,272	6,791	35,063	3,861	464	4,830	4,097
June.....	4,125	24,444	28,569	6,388	34,957	3,811	560	4,891	4,101

¹ Panama R. R. includes Panama R. R., commissary, and relocation.

EXHIBIT 3.—Occupants of commission quarters, June 30, 1912.

Place.	Gold.			Europeans.			West Indians.		
	Men.	Women.	Children.	Men.	Women.	Children.	Men.	Women.	Children.
Balboa.....	252	90	124	263			355		
Ancon.....	417	243	123	73			742	11	3
Corozal.....	379	80	78	226			290	5	5
Miraflores.....	19	2	1	580	3	11	139	5	4
Pedro Miguel.....	272	74	77	333	6	9	302	31	36
Paraiso.....	213	78	81	255	3	11	245	137	171
Culebra.....	346	188	181	413	47	90	370	120	174
Empire.....	509	312	299	505	59	76	536	126	182
Las Cascadas.....	174	101	86	208	36	52	277	129	137
Bas Obispo.....	77	43	49	263	48	70	200	35	37
Gorgona.....	718	240	297	90	11	22	310	109	141
Gatun.....	790	211	192	1,223	28	50	1,096	22	33
Cristobal.....	759	262	273	349			1,294	209	351
Toro Point.....	61	14	23	64			321		
Porto Bello.....	49	22	29	81			221	2	2
Total.....	5,035	1,960	1,913	4,926	241	391	6,698	941	1,276

EXHIBIT 4.—Applications for married quarters on file June 30, 1912.

Stations.	List No. 1.	List No. 2.	Stations.	List No. 1.	List No. 2.
Balboa.....		40 (8)	Bas Obispo.....		29 (7)
Ancon.....	2 (1)	63 (18)	Gorgona.....		73 (32)
Ancon Hospital.....		1	Gatun.....	1	101 (12)
Corozal.....		62 (19)	Cristobal.....		126 (11)
Pedro Miguel.....	1 (1)	49 (9)	Toro Point.....	1	3
Culebra.....	1	47 (1)	Porto Bello.....		7 (5)
Empire.....		57 (25)			
Las Cascadas.....		33 (6)	Total.....	6 (2)	691 (153)

NOTE.—The figures in parenthesis show the number of applicants already occupying regular or nonhouse-keeping family quarters at stations other than those at which applications are filed.

EXHIBIT 5.—*Animals in commission corrals June 30, 1912.*

Stations.	Ameri- can horses.	Native ponies.	Mules.	Police ponies.	Private animals.	Total.
Ancon.....	30	6	116	14	41	207
Corozal.....	2		12	3		17
Pedro Miguel.....	2	1	19	3	11	36
Culebra.....	8	2	29	1	21	61
Empire.....	5	4	45	5	22	81
Las Cascadas.....		2	20	2	1	25
Gorgona.....		1	15	2	12	30
Gatun.....	3	1	50	3	6	63
Cristobal.....	15	1	69	1	29	115
Toro Point.....			2			2
Grand total.....	65	18	377	31	143	637

EXHIBIT 6.—*Number of buildings on the Canal Zone June 30, 1912.*

Stations.	Isthmian Canal Commis- sion.	French.	Total.	Stations.	Isthmian Canal Commis- sion	French.	Total.
Alhajuela.....	2	2	4	Las Sabanas.....	2		2
Ancon.....	202	41	243	Mamei.....	1		1
Balboa.....	97	27	124	Margarita Island.....	7		7
Bas Obispo.....	69	135	204	Miraflores.....	32	27	59
Camp "E. S. Otis".....	14	34	48	Naos Island.....	20		20
Cocoa Lane.....	1	1	2	New Frijoles.....	1		1
Colon Hospital.....	36	10	46	Nombre de Dios.....	9		9
Corozal.....	58	27	85	Palo Seco.....	16		16
Cristobal.....	155	105	260	Panama.....	1	2	3
Cruces.....	1		1	Paraiso.....	99	63	162
Culebra.....	188	70	258	Pedro Miguel.....	103	19	122
Culebra Island.....	9		9	Porto Bello.....	55		55
Empire.....	193	110	303	Taboga Island.....	5	4	9
Flamenco Island.....	3		3	Toro Point.....	34	1	35
Gatun.....	239		239	Vigia.....	1		1
Gorgona.....	149	108	257	Total.....	1,889	850	2,739
Las Cascadas.....	87	64	151				

EXHIBIT 7.—*Buildings constructed, fiscal year 1911-12.*

Department or division.	New structures.		Additions.		Total.	
	Number.	Cost.	Number.	Cost.	Number.	Cost.
Quartermaster's department and general use.....	3	\$214.33	7	\$5,466.18	10	\$5,680.51
Chief engineer:						
First division.....	2	288.22			2	288.22
Fortification.....	7	4,204.62			7	4,204.62
Atlantic division.....	2	6,059.65	1	253.87	3	6,313.52
Pacific division.....	1	253.99			1	253.99
Mechanical division.....			3	731.91	3	731.91
Subsistence department.....			3	63,937.85	3	63,937.85
Commissary department.....	1	53.28	2	1,027.61	3	1,080.89
Sanitary department.....	4	1,690.24	1	166.86	5	1,857.10
Civil administration.....	2	13,838.16			2	13,838.16
Canal Zone government.....			1	170.27	1	170.27
Total.....	22	26,602.49	18	71,754.55	40	98,357.04

SUMMARY.

	Number.	Cost.
New buildings.....	22	\$26,602.49
Additions to buildings.....	18	71,754.55
Buildings taken down in sections and moved to new locations.....	36	58,505.09
Buildings demolished and material used in construction of new buildings at other points.....	15	26,790.30
Total.....		183,652.43

EXHIBIT 8.—*Buildings sold and demolished, fiscal year 1911-12.*

Stations.	Buildings sold.		Buildings demolished.	Total sold and demolished.
	Number.	Amount received.		
Naos Island.....				
Balboa.....			2	2
Ancon.....			10	10
Corozal.....				
Pedro Miguel.....			1	1
Paraiso.....			2	2
Culebra.....	29	\$1,220. 00		29
Empire.....	1	50. 00	39	40
Las Cascadas.....	2	235. 00	2	4
Bas Obispo.....	1	30. 00	5	6
Gorgona.....	2	130. 00	12	14
San Pablo.....	7	215. 00	3	10
Tabernilla.....	43	2,133. 50	18	61
Frijoles.....	45	3,233. 25	30	75
Bohio.....	3	75. 00		3
Gatun.....	16	675. 00	4	20
Cristobal.....			2	2
			1	1
Total.....	149	7,996. 75	131	280

EXHIBIT 9.—Value of material received during the fiscal year 1911-12, on requisitions of the various departments.

Departments.	1911						1912						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Construction and engineering:													
Atlantic division.....	\$90,213.66	\$143,655.14	\$100,042.91	\$187,629.30	\$113,812.98	\$98,436.89	\$224,629.03	\$106,557.28	\$116,877.49	\$82,945.99	\$39,410.10	\$16,618.41	\$1,320,829.18
Central division.....	7,270.08	5,796.96	277.48	605.40	44.10	1,722.70	2.10	2.10	663,199.40	292,592.72	231,159.20	260.00	15,992.67
Pacific division.....	71,820.48	180,951.17	140,290.70	172,167.02	104,437.71	136,553.49	249,675.21	206,584.78	29,262.48	50,041.11	59,524.85	244,569.55	2,094,001.43
Mechanical division...	17,663.92	41,529.54	39,306.65	45,953.45	28,483.98	21,886.90	24,797.99	29,262.48	42,304.27	2,447.99	914.36	53,976.87	454,732.01
Chief engineer.....	448.03	691.80	753.81	253.58	3,416.80	6,893.68	601.77	24,922.32	2,406.69	203,543.75	105,602.88	1,903.00	45,653.83
First division.....	2,361.50	19,685.53	.....	20,993.71	10,330.58	81,148.57	46,731.36	105,961.11	204,034.41	14,310.27	4,073.02	433,157.51	1,233,550.91
Fortifications.....	.....	.....	.....	.....	.....	.....	.....	.....	12,105.44	.....	.....	20,537.33	51,026.06
Total.....	189,777.67	392,310.14	280,671.55	427,602.46	260,526.15	346,642.23	546,437.46	473,290.07	1,040,927.70	645,881.83	440,696.16	771,022.67	5,815,786.09
Quartermaster's department.....	241,220.38	141,806.84	302,500.04	319,260.46	220,573.48	447,998.79	417,573.42	428,564.10	520,560.83	285,660.22	336,545.97	324,964.40	3,987,228.93
Sanitary department.....	1,906.88	4,838.33	3,546.07	7,076.28	5,749.00	3,051.46	4,099.03	2,688.83	5,363.02	7,313.32	6,844.53	16,472.57	68,951.32
Examiner of accounts.....	.....	.....	.....	.....	.....	277.80	2,041.35	2,482.50	35.00	158.03	17.00	370.00	5,381.68
Department of civil administration.....	1,876.25	792.22	4,129.64	1,456.79	3,190.77	865.63	875.42	840.39	177.91	19,458.69	1,785.56	1,909.13	37,358.40
Disbursing officer.....	143.75	5.50	92.00	9.50	5.25	15.00	232.16	.....	.....	.....	95.55	11.50	232.16
Department of law.....	11,019.26	2,667.35	1,359.50	103,528.55	14,026.18	83,356.55	121,102.67	38,994.36	80,540.67	43,192.10	34,372.09	67,703.03	459.88
Panama R. R. Co.....	445,944.19	542,420.38	592,298.80	858,934.04	504,070.83	882,207.46	1,092,365.51	946,886.58	1,647,656.63	1,001,666.19	820,356.86	1,182,453.30	601,862.31
Grand total.....	109,502.67	125,551.55	118,886.28	128,460.04	119,792.27	113,876.96	127,763.00	131,320.03	140,788.92	156,650.67	268,108.26	.....	1,540,700.65
Local purchases on Isthmus:													
Coal purchased from Panama R. R. Co.....	14,071.42	4,407.81	6,812.53	6,885.01	4,984.45	2,238.09	1,757.90	857.58	3,240.42	17,768.67	5,823.39	1,434.76	70,282.03
Miscellaneous purchases from Panama R. R.....	459.83	613.52	794.63	8,757.55	900.00	3,161.50	2,161.11	1,571.37	1,282.60	.....	3,959.85	2,232.25	25,894.21
Miscellaneous from Panama R. R. commissary.....	76,149.21	81,854.11	82,486.04	88,448.12	75,272.86	73,666.23	78,869.67	76,467.32	94,437.62	83,612.09	166,791.99	.....	978,055.26
Crude oil from Union Oil Co.....	428.24	1,668.69	851.63	2,125.72	2,404.78	4,996.29	314.20	3,305.95	2,090.00	3,023.84	926.11	1,900.49	24,035.94
Miscellaneous purchases from local merchants.....	.....	.....	.....	.....	.....	173.00	.....	.....	275.00	.....	.....	.....	448.00
Postage stamps.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total—Local purchases on Isthmus.....	200,611.37	214,095.68	209,831.11	234,676.44	203,354.36	198,112.07	210,865.88	213,522.25	242,114.56	261,055.27	445,609.60	5,507.50	2,639,416.09

NOTE.—In addition, there was paid to the McClintic-Marshall Construction Co. on Washington order No. 23444, covering 50 per cent of invoice value of lock-gate leaf material inspected and accepted, the sum of \$1,528,227.47.

EXHIBIT 10.—Freight statement, July 1, 1911, to June 30, 1912.

Steamship lines.	Number of steamers.	General cargo.	Cement.	Lumber.	Ties.		Piling.	Total weight.	
					Pieces.	Feet b. m.		Pounds.	Tons.
Panama R. R. Co.	77	Pounds. 38,108,631	Pounds. 1 286,575,200	Feet b. m. 500,079	.....	.....	Pieces.	326,684,147	163,342
United Fruit Co.	137	35,467,707	.....	11,497,285	31,896	1,435,320	4,197	87,198,127	43,599
Hamburg-American.	49	2,176,535	.....	114,309	.....	.....	.....	2,633,771	1,317
Leyland Line.	16	1,078,996	.....	.....	.....	.....	.....	1,078,996	539
Royal Mail.	20	682,190	.....	.....	.....	.....	.....	682,190	341
Pacific Mail.	20	377,962	.....	151,431	.....	.....	.....	983,686	492
California-Atlantic.	28	7,707,613	.....	4,048,794	.....	.....	.....	23,902,789	11,951
Tramps:									
Pacific.	14	1,500,000	.....	9,900,908	4,560	205,200	250	41,924,432	20,962
Atlantic.	76	113,972,418	2 361,998,700	826,899	242,458	10,910,610	15,268	522,921,154	261,461
Total.	437	201,072,052	3 648,573,900	27,039,705	278,914	12,551,130	4 19,715	1,008,009,292	504,004

¹ Equivalent to 716,438 barrels.² Equivalent to 994,997 barrels.³ Equivalent to 1,621,435 barrels.⁴ 1,099,285 linear feet.

NOTE.—The total weights given above do not include the weight of piling. In addition to the above one dredge, Corozal, was received.

EXHIBIT 11.—Important items due on United States requisitions June 30, 1912.

Articles.	Quantity.	Value.
Bridge, bascule, for Panama R. R.	1	\$24,390.00
Cement..... barrels..	1,652,857	1,520,628.44
Dynamite..... pounds..	3,986,500	463,003.50
Other blasting supplies.....		69,464.27
Lumber..... feet b. m..	13,319,759	420,096.41
Material for locks:		
Lock-gate leaves (includes cost of erection).....		3,846,247.35
Machinery to operate Stoney gate valves.....		755,084.96
Emergency dams.....		2,146,850.35
Locomotive track material.....		153,611.82
80 gate recess covers.....		1,416.00
Miter gate moving and miter forcing machinery.....		658,261.06
Gates, caissons, fixed irons, footbridges for spillways, etc.....		213,402.12
Plant and materials for hydroelectric station at Gatun.....		137,281.58
Material for chain fenders for all locks.....		469,754.84
Electric towing locomotives for all canal locks.....		522,967.35
Snubbing posts and springs, anchors, etc., for buffers on lock walls.....		7,212.24
Spillway gate machines and spare parts.....		71,363.29
Miscellaneous material for rack railway and miter gates.....		6,442.75
Crank gear recess cover seats.....		19,970.07
General control apparatus for lock machinery.....		200,081.00
Motors, centrifugal pumps, etc., for all locks.....		173,514.66
Crossovers for electric towing locomotives.....		44,142.00
Insulated cable for the power supply and control of lock machinery.....		132,028.60
Transformer-room equipment for all locks.....		251,405.37
Auxiliary electric equipment for hydroelectric station, Gatun.....		46,000.00
		9,857,037.41
Material for lighting and buoying the canal.....		164,970.00
Piling..... pieces..	6,428	141,347.73
Rail, steel..... gross tons..	900	28,215.00
Ties, cross and switch.....	40,000	31,520.00
Supplies, foundry.....		39,200.80
Tanks, 4, steel, for oil storage.....		80,000.00

EXHIBIT 12.—Important items of material purchased from inception of canal work, 1904, to June 30, 1912.

Articles.	Quantity.	Value.	Articles.	Quantity.	Value.
Barges.....	44	\$1,092,830.00	Live stock:		
Boats, tug.....	9	566,734.00	Horses.....		\$39,212.50
Brick—building, fire, and paving.....		256,307.60	Mules.....		99,572.50
Cableways.....	7	365,050.90	Cows.....		10,650.00
Cars.....	4,181	4,655,355.79			149,434.50
Cement..... barrels..	4,594,143	4,772,594.94	Locomotives.....	189	1,942,502.00
Compressors, air.....	28	125,504.77	Lumber..... feet b. m..	205,004,334	4,822,182.12
Cranes.....	87	666,228.81	Material for locks.....		4,954,915.55
Dredges.....	14	2,292,128.00	Piling..... pieces..	132,078	1,548,374.00
Drills, rock.....	725	288,376.59	Plants:		
Drivers, pile.....	4	28,305.00	Power.....	3	366,523.97
Explosives:			Material handling... ..	3	689,358.60
Dynamite..... pounds..	49,810,389	5,980,815.96	Rock crusher.....	4	200,164.68
Other blasting supplies.....		586,803.73	Filtration.....	3	33,260.00
Forage and corral supplies.....		707,112.50	Pumping.....	2	14,950.00
Furniture:			Boiler.....	2	114,961.00
Married quarters.....		271,025.74	Hydraulic dredging ..	1	192,868.00
Bachelor quarters.....		147,143.50	Steel foundry.....	1	11,742.39
Hospital quarters.....		76,666.65	Rails, steel.....	62,537	1,970,419.75
Laborers' quarters.....		208,809.00	Roofing, corrugated iron.....		488,420.20
		703,644.89	Screening, wire.....		394,829.25
			Shovels, steam.....	102	1,094,879.96
			Spreaders, earth.....	26	139,687.00
			Ties, cross and switch.....	2,035,218	1,677,630.21
			Unloaders.....	29	158,839.00

EXHIBIT 13.—*Important items of material received July 1, 1911, to June 30, 1912.*

Articles.	Quantity.	Value.
Cement.....barrels..	1,621,435	\$1,491,720.20
Cranes.....	13	106,600.00
Dredge.....	1	399,340.00
Dynamite.....pounds..	9,478,639	1,250,413.74
Other blasting supplies.....		88,631.33
Forage and corral supplies.....		88,614.22
Lumber.....feet b. m..	27,223,119	758,919.02
Material for locks and lock work:		
Valve frames.....		8,439.21
Lock-gate leaves.....		1,528,227.47
Fixed irons for rising stem gate valves, etc.....		155,456.59
Machinery to operate Stoney gate valves.....		193,124.00
Emergency dams.....		96,218.03
Locomotive track material.....		549,162.57
80 gate recess covers.....		127,944.00
Miter gate moving and miter forcing machinery.....		23,785.60
Gates, caissons, fixed irons, and footbridges for spillways.....		324,263.66
4 intake bridges, etc.....		20,951.42
Vitrified tile and mandrels.....		85,350.00
Plant and materials for hydroelectric station at Gatun.....		19,305.00
Snubbing posts and springs, anchors, etc., for buffers on lock walls.....		18,135.31
Miscellaneous material for rack railway and miter gates.....		2,926.01
Crank gear recess cover seats.....		10,451.57
		3,163,740.44
Oils and greases.....		125,973.81
Piling.....pieces..	19,715	298,794.22
Rails, steel.....gross tons..	2,650	83,077.50
Other track material.....		152,086.52
Steel—flat, round, square, tool, etc.....		94,042.99
Steel for Cristobal dock construction.....		228,165.07
Ties, cross and switch.....	278,914	219,784.23

EXHIBIT 14.—*Values of stock on hand at storehouses.*

Storehouses.	June 30, 1911.	June 30, 1912.	Storehouses.	June 30, 1911.	June 30, 1912.
Porto Bello.....	\$100,345.26	\$75,714.74	Culebra.....	\$5,294.54	\$3,429.13
Toro Point.....	20,693.76	25,490.36	Pedro Miguel.....	30,633.03	24,664.81
Cristobal shops.....	109,994.72	70,076.22	Miraflores.....	138,239.60	101,929.77
Dry dock store.....	250,755.65	194,906.69	Corozal.....	1,990.73	1,332.88
Mount Hope depot.....	1,502,838.23	1,363,879.79	Ancon.....	10,766.40	16,003.08
Gatun.....	338,035.71	271,610.16	Balboa.....	207,892.14	143,601.18
Tabernilla.....	1,926.78				
Gorgona.....	841,072.54	644,748.91	Total.....	4,511,781.46	3,721,212.90
Las Cascadas.....	15,265.12	10,772.80	Decrease in stock value		
Empire.....	936,037.25	773,052.38	as of June 30, 1912.....		790,568.56

EXHIBIT 15.—*Classification of material in stock at storehouses.*

Class No.		June 30, 1911.	June 30, 1912.
1	New York air-brake material.....	\$27,369.05	\$21,258.94
2	Westinghouse air-brake material.....	56,583.60	46,140.37
3	Lubricators, oil cups, and parts.....	20,295.53	18,358.96
4	Injectors, inspirators, ejectors, and parts.....	39,405.12	35,731.59
5	Pop valves and parts.....	15,224.38	13,836.86
6	Steam, air, and vacuum gauges, and parts.....	2,121.25	1,415.11
7	Water gauges and fittings.....	5,156.04	2,971.49
8	Miscellaneous boiler and engine fittings.....	9,093.64	10,392.04
9	Twist drills, reamers, cutters, tools, etc.....	24,194.30	21,363.60
10	Pneumatic and electric hand tools and parts.....	19,469.18	14,523.56
11	General stock of electrical material.....	180,327.44	134,498.56
12	Special stock of electrical material.....	49,970.14	46,571.16
13	Car repair parts.....	188,805.45	143,463.30
14	Crane repair parts.....	62,509.28	52,812.69
15	Locomotive repair parts.....	87,030.35	76,311.04
16	Lidgerwood unloader repair parts.....	13,553.31	14,004.93
17	Spreader repair parts.....	11,202.34	10,596.55
18	Pile driver repair parts.....	1,314.68	957.99
19	Track shifter repair parts.....	34.72	69.66
20	Motor car repair parts.....	1,867.06	3,389.92
21	Steam shovel repair parts.....	396,675.98	319,550.60
22	Rock channeler repair parts.....	1,090.50	543.85
23	Well drill repair parts.....	23,619.00	12,787.21
24	Rock drill repair parts.....	68,628.64	48,566.52
25	Drill sharpener repair parts.....	964.23	887.13
26	Tugboat repair parts.....	16,406.83	5,102.91
27	Suction dredge repair parts.....	108,754.36	91,209.26
28	Ladder dredge repair parts.....	53,756.33	28,842.54
29	Dipper dredge repair parts.....	39,787.84	25,300.36
30	Clapnet repair parts.....	4,286.75	3,805.69
31	Towing machine repair parts.....	3,896.74	3,001.32
32	Barge repair parts.....	3,216.62	4,500.80
33	Miscellaneous repair parts.....	75,759.26	64,852.19
34	Cableway repair parts.....	17,307.66	20,748.23
35	Track material, except track tools.....	105,712.19	189,947.04
36	Air compressor repair parts.....	3,906.47	4,654.88
37	Explosives, fuses, etc.....	25,056.93	143,063.68
38	Blasting batteries, galvanometers, and parts.....	1,181.09	3,381.69
39	Rough castings.....	169,614.99	131,967.83
40	Foundry supplies only.....	37,535.69	40,719.03
41	Miscellaneous machine parts.....	22,982.88	31,186.93
42	Miscellaneous material not carried at Mount Hope depot.....	62,313.95	61,578.37
43	Miscellaneous material carried at Mount Hope depot.....	2,453,799.67	1,816,286.50
	Total.....	4,511,781.46	3,721,212.90
	Net reduction in stock.....		790,568.56

EXHIBIT 16.—*Material returned to stock by departments and divisions, July 1, 1911, to June 30, 1912.*

Atlantic division.....	\$247,701.51
Central division.....	294,659.01
Pacific division.....	68,733.22
Mechanical division.....	65,126.98
Relocation, Panama Railroad.....	138,086.85
Chief engineer:	
First division.....	47.80
Lighthouse subdivision.....	610.75
Third division.....	41.95
Fortification work.....	2,921.67
Department of civil administration.....	120.42
Department of sanitation.....	2,325.65
Subsistence department.....	1,128.78
Old main line, Panama Railroad.....	40,044.02
Miscellaneous.....	852.17
	<u>862,400.78</u>

Material turned in by storehouses as surplus:

To storehouse at—	
Mount Hope depot.....	265,425.26
Gorgona store.....	95,507.74
Empire store.....	61,567.65
Obsolete store.....	57,402.51
	<u>479,903.16</u>
Total.....	<u>1,342,303.94</u>

APPENDIX K.

REPORT OF LIEUT. FRANK O. WHITLOCK, FOURTEENTH CAV- ALRY, UNITED STATES ARMY, ACTING SUBSISTENCE OFFI- CER, IN CHARGE OF SUBSISTENCE DEPARTMENT.

ISTHMIAN CANAL COMMISSION,
SUBSISTENCE DEPARTMENT,
Cristobal, Canal Zone, July 23, 1912.

SIR: I have the honor to submit the following report of the operations of the subsistence department for the fiscal year ended June 30, 1912.

On June 30, 1912, this department was operating 19 line hotels, 3 night restaurants, 18 European laborers' messes, and 18 common laborers' kitchens—an increase of 2 messes and 4 kitchens over last year. Wherever required by canal or fortification construction work, hotels, messes, and kitchens have been operated. The hotel and kitchen at Nombre de Dios and the hotel at Tabernilla were closed during the year because work at those points was completed; one of the two messes at Bas Obispo was also closed. Hotels, messes, and kitchens were opened at Naos Island and at Fort Randolph, a mess and kitchen at Corro, and kitchens at Rio Grande and Paraiso. The territory served by this department is divided into 15 districts, each in charge of a chief steward, who reports direct. In addition we have the Hotel Tivoli, which serves the people visiting the Isthmus.

The total revenue for the year from the line hotels, restaurants, messes, and kitchens was \$1,263,869.81, an increase of \$9,607.41 over last year; the total cost of operations was \$1,226,352.16, an increase of \$4,882.90; the profit was \$37,517.65, an increase of \$4,724.51 over last year. The ratio of supplies consumed to revenue was 0.41 per cent more than last year and of expense to revenue 0.77 per cent less, making the ratio of total cost of operations to revenue 0.36 per cent less than last year. The percentage of profit to revenue was 2.97 per cent, 0.36 per cent greater than last year.

The expense for salaries and wages for line hotels, restaurants, messes, and kitchens was \$163,006.78, a reduction of \$10,022.74 from last year. The proportion of pay roll to revenue was 12.8 per cent, 0.9 per cent less than last year.

The total number of meals served in line hotels was 2,075,335—141,405 (6.38 per cent) less than last year; the total number of rations served in European laborers' messes was 1,108,175—53,630 (5.09 per cent) more than last year; the total number of rations served in common laborers' kitchens was 584,457—139,954 (31.49 per cent) more than last year. The average daily attendance during June, 1912, was 2,682 at the line hotels, 2,834 at the messes, and 1,446 at the kitchens. The attendance at the line hotels was determined on the basis that each guest averages two meals per day.

The following table shows the quantities and costs of the principal articles consumed in the line hotels, restaurants, messes, and kitchens during the year:

Article.	Quantity.	Cost.	Article.	Quantity.	Cost.
Beef:			Macaroni.....pounds..	206,827	\$14,837.94
Fresh.....pounds..	2,782,044	\$276,924.39	Milk.....tins..	229,742	19,878.41
Salt.....do.....	28,533	3,330.82	Mutton, fresh.....pounds..	22,532	2,547.35
Bacon.....do.....	64,231	14,602.80	Onions.....do.....	175,730	7,528.04
Beans.....do.....	227,743	12,804.82	Peas.....do.....	126,998	6,609.35
Butter.....do.....	111,363	39,825.48	Pork:		
Bread.....do.....	2,707,652	108,298.08	Fresh.....do.....	133,409	20,308.46
Cabbage.....do.....	167,190	6,250.90	Salt.....do.....	4,673	576.21
Cocoa.....do.....	32,798	5,211.72	Potatoes:		
Coffee.....do.....	83,953	16,015.04	White.....do.....	1,436,950	45,445.27
Eggs.....dozen..	181,787	57,416.65	Sweet.....do.....	251,967	4,519.02
Fish:			Poultry.....do.....	189,934	32,338.58
Fresh.....pounds..	113,641	8,464.75	Rice.....do.....	483,717	13,909.85
Canned.....tins..	41,602	3,850.64	Rolls.....dozen..	45,262	10,217.51
Cured.....pounds..	60,109	4,849.28	Sugar:		
Flour.....do.....	472,811	14,191.95	Granulated....pounds..	216,492	11,768.15
Fruits:			Yellow.....do.....	631,557	28,127.79
Fresh.....do.....		27,537.15	Tea.....do.....	9,271	2,989.99
Canned.....tins..	81,458	23,267.86	Veal, fresh.....do.....	80,636	12,369.75
Garbanzos.....pounds..	227,808	9,698.60	Vegetables:		
Ham.....do.....	36,238	7,017.00	Fresh.....do.....		18,879.48
Ice cream.....gallons..	53,590	27,255.00	Canned.....tins..	150,932	22,326.82
Lamb, fresh.....pounds..	17,345	2,312.40	Yams.....pounds..	65,175	1,955.25
Lard.....do.....	108,842	11,115.19			

The Hotel Tivoli bettered its accommodations during the year, building a new wing and increasing number of rooms opening on private bath from 28 to 90. It also bought and paid for as an operating expense furniture and other equipment to the amount of approximately \$10,000. The greater part of this equipment was for the new rooms. The Tivoli successfully served all parties visiting the Isthmus.

As a result of the year's operations the line hotels and restaurants showed a loss of \$12,085.37, the European laborers' messes showed a profit of \$38,455.78, and the common laborers' kitchens showed a profit of \$11,147.24. The profit for the year resulting from the operation of the Hotel Tivoli was \$53,652.36. The total profits amounted to \$91,170.01, an increase over last year of \$31,949.82.

Tables showing details of the financial operations are attached hereto.

Very respectfully,

F. O. WHITLOCK,
Acting Subsistence Officer.

Col. GEORGE W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

TABLE 1.—Statement of operations—line hotels, restaurants, messes, and kitchens—July 1, 1911, to June 30, 1912.

	1911						1912						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies on hand and in transit.....	\$21,331.21	\$17,538.06	\$18,026.68	\$19,356.78	\$18,912.97	\$19,458.71	\$19,346.92	\$18,010.38	\$18,099.23	\$17,459.27	\$17,991.46	\$18,492.39	\$224,024.06
Supplies purchased.....	78,833.61	86,222.33	9,935.16	95,532.98	95,376.85	97,472.47	97,598.46	98,565.55	97,095.39	92,625.92	91,157.69	88,996.70	1,100,413.11
Supplies from hotels, messes, and kitchens.....	37,656.30	40,510.41	43,608.23	48,075.00	46,868.56	48,135.02	48,190.46	43,405.27	45,870.88	44,782.41	45,079.79	43,339.06	535,521.39
Total to account for.....	137,821.12	144,270.80	152,570.07	162,964.76	161,158.38	165,066.20	165,135.84	154,981.20	161,065.50	154,867.60	154,228.94	145,828.15	1,859,958.56
Discounts allowed.....	4,157.37	4,549.76	4,845.42	5,113.19	5,085.23	5,231.44	5,253.71	5,678.32	5,877.03	5,591.20	7,054.23	6,541.00	64,977.90
Credit notes.....	276.24	340.12	483.88	262.67	321.37	454.60	342.94	422.31	309.43	255.50	306.41	308.55	4,084.02
Supplies to cleaning.....	951.01	917.13	970.41	982.21	891.61	937.19	948.06	927.29	966.19	860.71	960.45	868.92	11,181.18
Supplies to hotels, messes, and kitchens.....	37,650.42	40,510.41	43,609.28	48,075.00	46,862.16	48,141.80	48,208.56	43,405.27	45,870.88	44,782.41	45,093.63	43,343.06	535,552.88
Supplies on hand and in transit.....	17,538.06	18,026.68	19,356.78	18,912.97	19,458.71	19,346.92	18,010.38	18,099.23	17,459.27	17,991.46	18,492.39	17,391.79	220,084.64
Total credits.....	60,573.10	64,344.10	69,265.77	73,346.04	72,619.08	74,111.95	72,763.65	68,532.42	70,482.80	69,481.28	71,907.11	68,453.32	835,880.62
Total supplies consumed.....	77,248.02	79,926.70	83,304.30	89,618.72	88,539.30	90,954.25	92,372.19	86,448.78	90,582.70	85,386.32	82,321.83	77,374.83	1,024,077.94
Supplies to cleaning.....	951.01	917.13	970.41	982.21	891.61	937.19	948.06	927.29	966.19	860.71	960.45	868.92	11,181.18
Pay roll:	2,074.89	2,605.62	2,207.38	2,000.55	1,878.86	2,440.91	2,728.66	2,127.01	2,152.78	2,281.75	2,288.22	2,390.15	27,176.78
Proportion general force, hotel, restaurant, mess, and kitchen help.....	10,549.51	10,816.01	11,166.17	11,378.97	11,302.38	11,147.55	11,345.04	11,524.53	11,394.44	11,657.15	11,491.63	11,059.54	134,832.92
Laundry.....	1,134.40	1,320.59	1,268.51	1,384.10	1,262.60	1,376.70	1,410.47	1,263.69	1,474.81	1,505.38	1,462.25	1,399.78	16,263.28
Fuel.....	591.99	591.99	591.99	591.99	591.99	591.99	591.99	591.99	591.99	591.99	591.99	591.99	7,103.88
Electric light and power.....	193.00	193.00	96.50	91.60	91.60	91.60	97.20	97.20	97.20	97.20	97.20	97.20	1,147.50
Equipment:	310.23	301.47	390.95	308.67	193.29	272.17	580.62	465.19	285.68	445.71	397.58	210.40	4,161.96
Straight.....	75.52	87.13	85.96	105.39	131.85	141.56	21.57	8.82	112.58	140.58	86.47	92.22	1,089.65
Expendable.....	15,687.55	16,832.94	16,777.87	16,843.48	16,344.18	16,999.67	17,723.61	17,005.72	17,075.67	17,580.47	17,375.79	16,710.20	202,957.15
Less equipment returned and credits.....	115.59	.....	223.44	30.00	162.65	.....	7.50	.....	2.92	.....	.....	.....	542.10
Less pay-roll deductions (breakage).....	14.22	10.88	14.12	5.68	4.66	11.44	13.93	22.88	14.60	9.70	9.69	9.03	140.83
Total expense.....	15,557.74	16,822.06	16,540.31	16,807.80	16,176.87	16,988.23	17,702.18	16,982.84	17,058.15	17,570.77	17,366.10	16,701.17	202,274.22
Total cost of operations.....	92,805.76	96,748.76	99,844.61	106,426.52	104,716.17	107,942.48	110,074.37	103,431.62	107,640.85	102,957.69	99,687.93	94,076.00	1,226,352.16

TABLE 1.—Statement of operations—line hotels, restaurants, messes, and kitchens—July 1, 1911, to June 30, 1912—Continued.

	1911						1912						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Coupons and tickets.....	\$90.654.72	\$95,786.60	\$99,208.61	\$104,952.06	\$101,110.15	\$104,891.86	\$107,772.51	\$101,039.53	\$106,343.09	\$101,040.88	\$99,940.47	\$93,513.85	\$1,206,254.93
Mess kits.....	18.30	129.60	102.72	17.92	32	.....	2.88	1.28	2.88	.....	.....	.....	275.90
Cash.....	1,517.32	1,469.10	1,388.91	1,882.80	1,334.52	1,415.80	1,542.63	2,133.40	2,781.75	1,657.55	1,246.70	1,230.50	19,200.98
Sanitary department.....	363.07	378.75	366.53	356.52	324.21	296.60	310.25	282.54	265.49	222.94	261.17	276.33	3,724.40
Civil administration.....	2,155.94	2,166.75	2,179.04	2,581.72	2,398.04	2,400.10	2,446.85	2,371.34	2,371.72	2,366.39	2,467.40	2,113.70	28,018.99
Third division, chief engineer.....	96.13	106.40	27	1.60	.....	.....	.....	.....	.....	.....	.....	.....	204.40
Construction and engineering.....	785.85	829.38	745.59	722.97	408.09	.....	6.93	.....	.....	.....	.....	.....	3,498.81
Y. M. C. A.....	137.03	117.16	118.94	165.90	144.56	145.40	174.46	200.40	183.11	159.36	190.48	181.32	1,918.12
Chairman's office.....	1.50	2.70	5.10	6.30	8.70	3.60	1.20	2.85	2.70	1.50	2.40	.90	39.45
Quartermaster's department.....	34.20	15.90	5.40	.....	.....	.....	2.40	28.20	54.90	3.20	1.80	.....	50.10
Panama R. R.....	.....	.30	.....	2.79	1.50	3.00	71.10	13.50	5.40	.....	56.70	.....	103.49
Hotel Tivoli.....	.....	.....	.....	7.50	16.80	25.80	.....	.....	.....	.....	.....	.....	196.80
Second division, chief engineer.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.27	2.27
Miscellaneous collections.....	71.97	.....	12.00	39.30	1.90	99.00	.....	157.00	.....	.....	.....	.....	381.17
Total revenue.....	95,856.03	101,002.64	104,133.11	110,237.38	105,848.79	109,281.16	112,331.21	106,230.04	112,011.64	105,451.82	104,167.12	97,318.87	1,263,869.81
Total net profit.....	3,050.27	4,253.88	4,288.50	3,810.86	1,132.62	1,338.68	2,256.84	2,798.42	4,370.79	2,494.73	4,479.19	3,242.87	37,517.65

TABLE 2.—Statement of operations line hotels and restaurants, July 1, 1911, to June 30, 1912.

	1911						1912						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies on hand and in transit.....	\$19,586.86	\$15,848.53	\$16,499.41	\$18,009.10	\$17,331.22	\$17,942.25	\$17,498.03	\$16,362.93	\$16,531.65	\$15,674.45	\$16,518.69	\$17,041.77	\$204,846.89
Supplies purchased.....	73,913.77	81,082.11	84,839.57	88,153.01	88,509.62	89,750.91	90,403.57	86,211.58	89,144.19	86,165.93	85,371.99	79,754.69	1,023,300.94
Supplies from hotels, messes, and kitchens.....	7,835.14	7,524.93	7,156.26	8,436.05	8,226.03	8,171.72	8,427.49	8,899.47	9,522.65	8,941.32	8,656.96	8,787.82	100,585.84
Total to account for.....	101,337.77	104,455.57	108,495.24	114,598.16	114,066.87	115,864.88	116,329.09	111,473.98	115,198.49	110,781.70	110,547.64	105,584.28	1,328,733.67
Discounts allowed.....	3,445.73	3,719.04	3,926.24	4,060.13	4,007.51	4,147.42	4,321.93	4,595.95	4,746.88	4,604.75	5,956.46	5,580.10	53,112.14
Credit notes.....	270.27	333.77	469.21	259.07	310.28	448.00	338.63	393.83	306.84	250.70	295.69	294.49	3,970.78

Supplies to cleaning.....	603.80	568.64	613.13	621.33	544.97	595.02	564.87	581.16	617.13	535.48	567.29	559.73	6,972.55
Supplies to hotels, messes, and kitchens.....	35,642.87	38,454.73	41,530.65	45,858.02	44,805.33	45,997.74	46,189.89	41,521.03	43,733.66	42,803.52	42,913.82	41,379.55	510,830.81
Supplies on hand and in transit.....	15,848.53	16,499.41	18,009.10	17,331.22	17,942.25	17,498.03	16,362.93	16,531.65	15,674.45	16,513.69	17,041.77	16,609.38	201,867.41
Total credits.....	55,811.20	59,575.59	64,548.33	68,129.77	67,610.34	68,686.21	67,778.25	63,623.62	65,078.96	64,713.14	66,775.03	64,423.25	776,753.69
Supplies consumed.....	45,526.57	44,879.98	43,946.91	46,468.39	46,456.53	47,178.67	48,550.84	47,850.36	50,119.53	46,068.56	43,772.61	41,161.03	551,979.98
Supplies to cleaning.....	603.80	568.64	613.13	621.33	544.97	595.02	564.87	581.16	617.13	535.48	567.29	559.73	6,972.55
Pay roll: Proportion to general force.....	1,181.81	1,389.24	1,116.94	1,001.05	944.00	1,232.91	1,390.77	1,148.17	1,164.44	1,219.32	1,223.49	1,267.25	14,279.39
Hotel help.....	7,161.91	7,158.58	7,152.40	7,198.18	7,201.29	7,061.66	7,174.79	7,339.09	7,458.40	7,513.21	7,432.54	7,202.48	87,054.53
Laundry.....	1,013.95	1,188.38	1,130.66	1,228.23	1,132.08	1,233.41	1,263.23	1,137.02	1,324.22	1,352.13	1,323.97	1,269.02	14,896.30
Total expense.....	9,961.47	10,304.84	10,013.13	10,048.79	9,822.34	10,123.00	10,393.66	10,205.44	10,564.19	10,620.14	10,547.29	10,298.48	122,902.77
Total cost of operation.....	55,488.04	55,184.82	53,960.04	56,517.18	56,278.87	57,301.67	58,944.50	58,055.80	60,683.72	56,688.70	54,319.90	51,459.51	674,882.75
Coupons (30 cents), tickets (40 cents).....	51,099.55	51,017.85	49,719.50	51,822.55	50,240.75	51,795.30	53,993.15	53,178.95	56,216.20	53,207.35	52,779.35	48,979.70	624,050.20
Cash.....	1,517.32	1,469.10	1,388.91	1,382.80	1,434.52	1,415.80	1,542.63	2,133.40	2,781.75	1,657.55	1,246.70	1,230.50	19,200.98
Sanitary department.....	76.00	53.68	44.80	37.01	32.48	37.11	40.00	28.00	25.20	13.87	33.07	20.80	442.02
Civil administration.....	1,183.94	1,164.87	1,075.55	1,176.01	1,228.67	1,343.50	1,373.06	1,268.48	1,339.24	1,278.23	1,208.98	1,177.79	14,818.32
Construction and engineer- ing.....	364.20	401.70	322.50	331.20	179.40	.....	.....	.....	.....	.....	.....	.....	1,599.00
Y. M. C. A.....	137.03	117.16	118.94	165.90	144.56	145.40	174.46	200.40	183.11	159.36	190.48	181.32	1,918.12
Panama Railroad.....	.....	30	5.40	2.79	1.50	3.00	2.40	28.20	54.90	1.20	1.80	.....	101.49
Chairman's office.....	1.50	2.70	5.10	6.30	8.70	3.60	1.20	2.85	2.70	1.50	2.40	.....	39.45
Quartermaster's department.....	34.20	15.90	.....	7.50	16.80	25.80	71.10	13.50	5.40	.....	56.70	.....	50.10
Hotel Tivoli.....	.....	.....	12.00	39.30	1.90	99.00	.....	157.00	.....	.....	.....	.....	196.80
Miscellaneous collections.....	71.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	380.90
Total revenues.....	54,485.44	54,243.26	52,692.70	54,971.36	53,289.28	54,868.51	57,198.00	57,010.78	60,600.50	56,319.06	55,519.48	51,591.01	662,797.38
Profit.....	1,002.60	941.56	1,267.34	1,545.82	2,989.59	2,433.16	1,746.50	1,045.02	75.22	369.64	1,199.58	131.50	1,331.08
Loss.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,416.45
Net loss.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,085.37
Meals served.....	170.082	170.008	165,289	172,250	167,042	171,862	179,213	178,921	188,979	176,527	174,159	160,943	2,075,335
Cost, supplies per meal, cents.....	25.14	24.82	25.08	25.43	26.22	25.79	25.51	25.28	24.90	24.60	23.69	24.00	25.04
Cost service per meal—cents.....	5.53	5.72	5.74	5.53	5.59	5.60	5.52	5.41	5.30	5.71	5.73	6.02	5.61
Total cost per meal, cents.....	30.67	30.54	30.82	30.96	31.81	31.39	31.03	30.69	30.20	30.31	29.42	30.02	30.65

TABLE 3.—Statement of operations—European laborers' messes, July 1, 1911, to June 30, 1912.

	1911						1912						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies on hand and in transit.....	\$1,742.35	\$1,689.53	\$1,527.27	\$1,347.68	\$1,581.75	\$1,516.46	\$1,848.89	\$1,647.45	\$1,667.58	\$1,784.82	\$1,472.77	\$1,450.62	\$19,177.17
Supplies purchased.....	4,919.84	5,140.22	6,095.59	7,379.97	6,867.23	7,721.56	7,194.89	7,353.97	7,951.20	6,459.99	5,785.70	4,242.01	77,112.17
Supplies from hotels, messes, and kitchens.....	21,450.29	22,304.41	23,882.39	26,844.15	27,341.30	29,245.23	28,892.39	24,566.86	25,652.62	25,370.13	25,942.85	24,867.39	306,360.01
Total to account for....	28,112.48	29,134.16	31,505.25	35,571.80	35,790.28	38,483.25	37,936.17	33,568.28	35,171.40	33,614.94	33,201.32	30,560.02	402,649.35
Discounts allowed.....	711.64	830.72	9,919.19	1,053.06	1,077.72	1,084.02	931.78	1,082.37	1,130.15	986.45	1,097.77	960.90	11,865.76
Credit notes.....	5.97	6.35	14.67	3.60	11.09	6.60	4.31	28.48	2.59	4.80	10.72	14.06	113.24
Supplies to cleaning.....	316.14	302.30	286.19	299.65	285.63	286.93	303.30	290.28	293.97	278.63	332.07	266.80	3,543.89
Supplies to hotels, messes, and kitchens.....	2,007.55	2,055.68	2,078.63	2,216.98	2,056.83	2,144.06	2,018.67	1,884.24	2,137.22	1,978.89	2,179.81	1,963.51	24,722.07
Supplies on hand and in transit.....	1,689.53	1,527.27	1,347.68	1,581.75	1,516.46	1,848.89	1,647.45	1,567.58	1,784.82	1,472.77	1,450.62	782.41	18,217.23
Total credits.....	4,730.83	4,722.32	4,646.35	5,155.04	4,947.73	5,370.50	4,905.51	4,852.95	5,350.75	4,721.54	5,070.99	3,987.68	58,462.19
Supplies consumed....	23,381.65	24,411.84	26,858.90	30,416.76	30,842.55	33,112.75	33,030.66	28,715.33	29,820.65	28,893.40	28,130.33	26,572.34	344,187.16
Supplies to cleaning.....	316.14	302.30	286.19	299.65	285.63	286.93	303.30	290.28	295.97	278.63	332.07	266.80	3,543.89
Pay roll:													
Proportion general force.....	665.65	867.07	773.24	719.18	693.61	921.91	1,012.05	737.87	737.97	784.71	793.10	835.13	9,541.49
Mess help.....	2,623.93	2,702.79	2,916.53	2,996.74	2,975.72	3,092.60	3,152.73	3,181.17	2,945.52	3,187.48	3,102.15	2,932.67	35,810.03
Laundry.....	92.38	101.79	103.49	120.17	103.63	115.73	115.92	99.41	121.08	119.73	107.42	103.69	1,304.44
Fuel.....	441.24	419.14	411.28	425.98	438.25	451.80	447.81	446.24	442.03	437.25	441.09	440.28	5,242.40
Electric light and power.....	.....	146.90	75.00	73.20	72.10	74.00	80.30	79.20	79.50	79.10	77.90	79.10	916.30
Equipment:													
Straight.....	276.37	279.60	372.06	270.19	165.71	248.23	535.26	429.95	284.62	427.76	356.33	210.40	3,856.48
Expendable.....	70.02	78.04	79.42	90.85	127.37	137.96	11.07	7.56	105.46	125.92	80.11	87.03	1,009.81
Less equipment returned and credits.....	4,485.73	4,897.63	5,017.21	5,004.96	4,862.03	5,329.16	5,658.44	5,271.68	5,012.15	5,440.58	5,290.17	4,955.10	61,224.84
Less pay-roll deductions (breakage).....	93.48	.....	223.44	30.00	125.25	.....	7.50	.....	.....	.....	.....	.....	479.67
Total expense.....	12.49	10.54	14.12	5.17	4.04	11.44	13.93	17.17	11.28	7.80	5.69	4.95	118.62
Total cost of operation.....	4,379.76	4,887.09	4,779.65	4,969.79	4,732.74	5,317.72	5,637.01	5,254.51	5,000.87	5,432.78	5,284.48	4,950.15	60,626.55
	27,761.41	29,298.93	31,638.55	35,386.55	35,575.29	38,430.47	38,667.67	33,969.84	34,821.52	34,326.18	33,414.81	31,522.49	404,813.71

Tickets, 40 cents, 27 cents, 13½ cents.....	30,400.01	32,464.84	35,264.53	39,295.47	38,701.99	41,173.46	41,469.52	36,628.29	38,053.44	36,044.31	35,726.68	33,764.39	438,986.93
Transfer tickets, 13½ cents, 9 cents.....	577.27	627.44	704.34	862.22	704.29	810.49	1,021.82	944.97	943.66	865.01	933.24	750.40	9,745.15
Sanitary department.....	241.73	260.27	260.53	265.87	244.93	217.73	221.47	206.93	187.73	165.33	198.13	229.07	2,699.72
Civil administration.....	37.17	13.41											50.58
Third division.....	96.13	106.40	.27	1.60									204.40
Construction and engineering Panama R. R.....							6.93						6.93
Second division, chief engi- neer.....										2.00			2.00
Mess kits, 32 cents.....		.32										2.27	2.27
Total.....	31,352.31	33,472.68	36,229.67	40,425.16	39,651.21	42,201.68	42,719.74	37,780.19	39,184.83	37,076.65	36,858.05	34,746.13	451,698.30
Less transfer tickets, 13½ cents	462.79	438.80	533.34	704.27	605.20	710.14	913.73	859.47	834.94	772.13	861.87	732.13	8,428.81
Total revenue.....	30,889.52	33,033.88	35,696.33	39,720.89	39,046.01	41,491.54	41,806.01	36,920.72	38,349.89	36,304.52	35,996.18	34,014.00	443,269.49
Net profit.....	3,128.11	3,734.95	4,057.78	4,334.34	3,470.72	3,061.07	3,138.34	2,950.88	3,528.37	1,978.34	2,581.37	2,491.51	38,455.78
Rations served.....	77,224	82,585	89,241	99,302	97,615	103,730	104,515	92,302	95,875	90,761	89,990	85,035	1,108,175
Cost supplies per ration, cents.....	30.28	29.56	30.10	30.63	31.59	31.92	31.60	31.11	31.10	31.83	31.26	31.25	31.06
Cost service per ration, cents.....	5.67	5.92	5.35	5.01	4.85	5.13	5.40	5.69	5.22	5.99	5.87	5.82	5.47
Total cost per ration, cents.....	35.95	35.48	35.45	35.64	36.44	37.05	37.00	36.80	36.32	37.82	37.13	37.07	36.53

TABLE 4.—Statement of operation, common laborers' kitchens, July 1, 1911, to June 30, 1912.

	Total.	1911						1912					
		July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
Supplies from hotels, messes, and kitchens.....	\$128,575.54	\$8,370.87	\$10,631.07	\$12,509.58	\$12,794.80	\$11,301.23	\$10,718.07	\$10,870.58	\$9,938.94	\$10,695.61	\$10,470.96	\$10,479.98	\$9,683.85
Supplies to cleaning.....	664.74	31.07	46.19	71.09	61.23	61.01	55.24	79.89	55.85	53.09	46.60	61.09	42.39
Supplies consumed.....	127,910.80	8,339.80	10,634.88	12,498.49	12,733.57	11,240.22	10,662.83	10,790.69	9,883.09	10,642.52	10,424.36	10,418.89	9,641.46
Supplies to cleaning.....	664.74	31.07	46.19	71.09	61.23	61.01	55.24	79.89	55.85	53.09	46.60	61.09	42.39
Pay roll:													
Proportion general force.....	3,355.90	227.43	349.31	317.20	280.32	241.25	286.09	325.84	240.97	230.37	277.72	271.63	287.77
Kitchen help.....	11,965.44	763.67	954.64	1,097.24	1,184.05	1,125.37	993.29	1,017.52	1,004.27	987.60	956.46	956.94	924.39
Laundry.....	362.54	28.07	30.42	34.36	35.70	26.89	27.56	31.32	27.26	29.51	33.52	30.86	27.07
Fuel.....	1,861.48	150.75	172.85	180.71	166.01	153.73	140.19	144.18	145.75	149.96	154.74	150.90	151.71
Electric light and power.....	231.20		46.10	21.50	18.40	19.50	17.60	16.90	18.00	17.70	18.10	19.30	18.10
Equipment:													
Straight.....	305.48	33.86	21.87	18.89	38.48	27.58	23.94	45.36	35.24	1.06	17.95	41.25	
Expendable.....	79.84	5.50	9.09	6.54	5.54	4.48	3.60	10.50	1.26	7.12	14.66	6.36	5.19
Total.....	18,826.62	1,240.35	1,630.47	1,747.53	1,789.73	1,659.81	1,547.51	1,671.51	1,528.60	1,496.41	1,519.75	1,538.33	1,456.62
Less equipment returned and credits.....	59.51	22.11				37.40							
Less pay-roll deductions (breakage).....	22.21	1.73	.34		.51	.62			5.71	3.32	1.90	4.00	4.08
Total expense.....	18,744.90	1,216.51	1,630.13	1,747.53	1,789.22	1,621.79	1,547.51	1,671.51	1,522.89	1,493.09	1,517.85	1,534.33	1,452.54
Total cost of operation.....	146,655.70	9,556.31	12,265.01	14,246.02	14,522.79	12,862.01	12,210.34	12,462.20	11,405.98	12,135.61	11,942.21	11,953.22	11,094.00
Coupons, 30 cents.....	10.80		1.50	9.30									
Tickets, 40 cents, 27 cents, 9 cents.....	143,207.00	9,155.16	12,302.41	14,215.28	13,834.04	12,167.41	11,923.10	12,309.84	11,232.29	12,074.05	11,789.22	11,434.44	10,769.76
Transfer tickets, 9 cents.....	487.44	21.06	49.77	55.17	49.05	35.19	42.48	43.38	37.89	50.40	31.05	32.58	39.42
Mess kits, 30 cents, 32 cents.....	275.58	18.30	129.28	102.72	17.92	.32		2.88	1.28	2.88			
Sanitary department.....	582.66	65.34	64.80	61.20	53.64	46.80	41.76	48.78	47.61	52.56	43.74	29.97	26.46
Civil administration.....	13,150.09	934.83	988.47	1,103.49	1,405.71	1,169.37	1,056.60	1,073.79	1,102.86	1,032.48	1,088.16	1,258.42	935.91
Construction and engineering.....	1,892.88	421.65	427.68	423.09	391.77	228.69							
Mechanical division.....	.27	.27											
Total.....	159,606.72	10,616.61	13,963.91	15,970.25	15,752.13	13,647.78	13,063.94	13,478.67	12,421.93	13,212.37	12,952.17	12,755.41	11,771.55

Less transfer tickets, 9 cents.	1,803.78	135.54	238.41	226.17	207.00	134.28	142.83	151.47	123.39	159.12	123.93	103.95	57.69
Total revenue.....	157,802.94	10,481.07	13,725.50	15,744.08	15,545.13	13,513.50	12,921.11	13,327.20	12,298.54	13,053.25	12,828.24	12,651.46	11,713.86
Net profit.....	11,147.24	924.76	1,460.49	1,498.06	1,022.34	651.49	710.77	865.00	892.56	917.64	886.03	698.24	619.86
Rations served.....	584,457	38,819	50,835	58,311	57,575	50,050	47,858	49,360	45,550	48,345	47,512	46,857	43,385
Cost supplies per ration, cents.....	21.88	21.48	20.92	21.43	22.11	22.45	22.28	21.86	21.70	22.01	21.94	22.24	22.22
Cost service per ration, cents.	3.21	3.13	3.21	3.00	3.11	3.24	3.23	3.39	3.34	3.09	3.20	3.27	3.35
Total cost per ration, cents.....	25.09	24.61	24.13	24.43	25.22	25.69	25.51	25.28	25.04	25.10	25.14	25.51	25.57

TABLE 5.—Statement of operation, Hotel Tivoli, July 1, 1911, to June 30, 1912.

	1911						1912						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Supplies on hand and in transit.....	\$2,950.12	\$2,830.10	\$2,807.78	\$3,026.42	\$3,520.68	\$4,324.48	\$4,009.95	\$4,909.59	\$4,905.43	\$4,205.37	\$3,511.27	\$3,185.29	\$44,186.48
Supplies purchased.....	5,369.30	5,775.92	5,786.25	6,523.13	7,295.91	8,067.91	11,292.47	13,306.55	13,415.12	9,047.90	7,041.63	5,658.97	98,581.11
Supplies from hotels, messes, and kitchens.....	.....	.....	1.05	.....	.....	6.78	18.10	.....	.....	.....	.84	4.00	30.77
Total to account for.....	8,319.42	8,606.02	8,595.08	9,549.55	10,816.59	12,399.17	15,320.52	18,216.14	18,320.55	13,253.27	10,553.79	8,848.26	142,798.36
Discounts allowed.....	263.01	274.58	266.38	327.25	351.55	396.84	548.83	655.04	638.41	424.53	409.28	352.90	4,908.60
Credit notes.....	4.84	33.81	.....	46.70	7.33	.61	.....	10.66	28.50	9.97	68.82	5.76	217.00
Supplies to cleaning.....	47.25	61.16	60.27	61.06	59.04	73.23	101.90	81.52	121.17	80.63	84.57	63.59	895.39
Supplies to quarters.....	114.57	97.15	156.56	164.96	151.84	174.75	173.76	199.88	237.85	233.20	228.42	170.54	2,103.48
Supplies to hotels, messes, and kitchens.....	5.88	.....	.....	.....	6.40	.....	.....	.....	.....	.....	.....	.....	12.28
Supplies on hand and in transit.....	2,830.10	2,807.78	3,026.42	3,520.68	4,324.48	4,009.95	4,909.59	4,905.43	4,205.37	3,511.27	3,185.29	3,385.53	44,621.94
Total credits.....	3,265.65	3,274.48	3,509.63	4,120.65	4,900.64	4,655.38	5,734.08	5,852.53	5,231.30	4,259.60	3,976.38	3,978.37	52,758.69
Supplies consumed.....	5,053.77	5,331.54	5,085.45	5,428.90	5,915.95	7,743.79	9,586.44	12,363.61	13,089.25	8,993.67	6,577.41	4,869.89	90,039.67
Supplies to cleaning.....	47.25	61.16	60.27	61.06	59.94	73.23	101.90	81.52	121.17	80.63	84.57	63.59	895.39
Supplies to quarters.....	114.57	97.15	156.56	164.96	151.84	174.75	173.76	199.88	237.85	233.20	228.42	170.54	2,103.48
Pay roll:													
Proportion general force.....	184.70	168.44	137.61	134.05	136.28	195.60	337.51	449.77	458.06	329.34	181.91	129.89	2,843.16
Hotel help.....	2,316.63	2,330.24	2,463.84	2,746.45	2,649.86	3,007.39	3,046.28	3,371.32	3,612.78	3,397.28	2,894.49	2,428.27	34,204.83
Laundry.....	576.01	664.51	541.96	622.82	603.82	727.86	909.15	1,156.00	1,171.51	1,002.37	720.73	512.03	9,208.86
Fuel.....	101.63	114.39	114.39	114.39	101.56	114.39	127.22	114.46	119.34	114.46	140.19	139.86	1,416.35
Electric light and power.....	.....	376.36	184.40	196.48	219.76	204.80	182.28	191.44	199.92	204.80	194.76	206.40	2,361.40
Equipment:													
Straight.....	36.85	123.54	2,336.83	253.11	241.33	1,362.64	1,450.79	711.25	2,947.03	625.85	506.28	95.30	10,690.80
Expendable.....	63.14	213.88	124.30	110.93	158.16	145.79	118.73	404.87	198.00	190.17	167.58	87.41	1,982.96
Stationery.....	.....	53.38	23.31	65.55	36.21	117.78	39.26	117.80	117.95	121.45	175.71	56.46	924.86
Telephones:													
Panama Telephone Co.....	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	120.00
Isthmian Canal Commission.....	.....	200.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	1,200.00
Expense vouchers—cashier.....	10.00	10.80	5.70	12.50	.....	20.00	11.20	.....	10.40	20.60	10.40	12.50	124.20
Baggage transfer.....	.....	.....	.....	.....	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	600.00
Miscellaneous.....	.....	.....	7.50	19.00	28.30	30.05	119.60	27.50	45.40	15.60	99.65	.....	392.60
	3,460.78	4,423.85	6,266.67	4,611.30	4,571.16	6,359.35	6,802.68	7,010.90	9,424.41	6,520.75	5,580.69	4,087.35	69,128.89

[illegible]

TABLE 7.—Summary of operation, Hotel Tivoli, July 1, 1911, to June 30, 1912.

	Sup- plies con- sumed.	Laun- dry.	Pay roll.		Miscel- lane- ous.	Fuel.	Light.	Equipment.		Total cost of opera- tion.	Cash.	Cou- pons.	D. O. collec- tions.	Ac- counts.	Total revenue.	Profit.	Loss.	Meals served.
			Gen- eral force.	Line, gold and silver.				Straight.	Ex- pend- able.									
1911.																		
July.....	\$5,053.77	\$576.01	\$184.70	\$2,316.63	\$181.82	\$101.63	\$181.67	\$33.65	\$63.14	\$8,329.68	\$10,947.20	\$530.70	\$21.50 ²	\$249.15	\$11,250.25	\$2,920.57		9,490
August.....	5,331.54	604.51	168.44	2,330.24	432.49	114.39	376.36	119.01	213.88	9,750.86	10,905.85	403.80	6.25	2 131.70	11,184.20	1,433.34		9,254
September.....	5,085.45	541.96	137.61	2,463.84	363.34	114.39	184.40	2,335.40	124.30	11,350.69	9,423.00	411.60	38.00	2 104.10	9,768.50		\$1,582.19	8,230
October.....	5,428.90	622.82	134.05	2,746.45	433.07	114.39	196.48	250.70	110.93	10,037.79	10,406.00	561.00	824.45	231.25	11,760.20	1,722.41		9,564
November.....	5,915.95	603.82	136.28	2,649.86	460.39	101.56	105.54	240.34	158.16	10,160.82	11,262.95	532.80	721.45	326.40	12,843.60	2,682.78		10,287
December.....	7,743.79	727.86	195.60	3,007.39	600.81	114.46	204.80	1,362.23	145.79	14,102.73	15,379.44	680.10	794.50	1,020.27	17,874.31	3,771.58		13,182
1912.																		
January.....	9,586.44	909.15	337.51	3,046.28	630.72	127.22	182.28	1,445.99	118.73	16,384.32	23,351.54	694.20	5.50	2 544.20	23,507.04	7,122.72		17,766
February.....	12,363.61	1,156.09	449.77	3,371.32	611.70	114.46	191.44	694.84	404.87	19,358.10	32,356.00	708.00		1,107.45	34,171.45	14,813.35		25,405
March.....	13,089.25	1,171.51	458.06	3,612.78	717.77	119.34	199.92	2,940.68	198.00	22,507.31	34,786.58	491.70	12.75	1,092.00	36,383.63	15,876.32		25,113
April.....	8,993.67	1,002.37	329.34	3,397.28	656.48	114.46	204.80	622.77	190.17	15,511.34	23,807.95	525.30	7.79	2,718.70	21,622.34	3,111.00		15,223
May.....	6,577.41	720.73	181.91	2,894.49	783.75	140.19	194.76	505.14	167.58	12,165.96	12,331.35	511.80	6.75	2 624.60	12,225.30	59.34		10,357
June.....	4,809.89	512.03	129.89	2,428.27	488.19	139.86	206.40	3 672.05	87.41	8,189.89	7,639.91	391.50	141.57	738.05	8,911.03	721.14		7,502
Total.....	90,039.67	9,208.86	2,843.16	34,264.83	6,360.53	1,416.35	1,854.43	9,878.70	1,982.96	157,849.49	202,597.77	6,442.50	2,580.51	118.93	211,501.85	53,652.36		161,373

¹ Credit: This amount, plus current month's charge, credited on previous charges by mechanical division.² Credit: This amount is preceding month's excess over current month.³ Credit: This amount, plus current month's charge, credited on previous charges by commissary department.

TABLE 6.—Summary of operations, July 1, 1911, to June 30, 1912.

	Supplies consumed.	Laundry.	Pay roll.		Miscellaneous.	Fuel.	Light.	Equipment.		Total cost of operations.	Cash.	Coupons and tickets.	Collections.	Total revenue.	Profit.	Loss.	Meals served.	Rations served.
			General force.	Line, gold and silver.				Straight.	Expendable.									
Line hotels and restaurants.																		
1911—July.....	\$45,526.57	\$1,013.95	\$1,181.81	\$7,161.91	\$603.89					\$55,488.04	\$1,517.32	\$51,099.55	\$1,868.57	\$54,485.44		\$1,002.60	170,082	
August.....	44,879.98	1,188.38	1,389.24	7,158.58	568.64					55,184.82	1,469.10	51,617.85	1,756.31	54,243.26		941.56	170,068	
September.....	43,946.91	1,130.66	1,116.94	7,152.40	613.13					53,966.04	1,388.91	49,719.50	1,584.29	52,692.70		1,267.34	165,289	
October.....	46,468.39	1,228.23	1,001.05	7,198.18	621.33					56,517.18	1,382.80	51,822.55	1,766.01	54,971.36		1,545.82	172,250	
November.....	46,456.53	1,132.08	994.00	7,201.29	544.97					56,278.87	1,434.52	50,240.75	1,614.01	53,289.28		2,989.59	167,042	
December.....	47,175.67	1,233.41	1,232.91	7,061.66	595.02					57,301.67	1,415.80	51,795.30	1,637.41	54,868.51		2,433.16	171,862	
1912—January.....	48,550.84	1,263.23	1,390.77	7,174.79	564.87					58,944.59	1,542.63	53,993.15	1,662.22	57,198.00		1,746.50	179,213	
February.....	47,850.36	1,137.02	1,148.17	7,339.00	581.16					58,055.80	2,133.40	53,178.95	1,698.43	57,010.78		1,045.02	178,921	
March.....	50,114.53	1,324.22	1,164.44	7,458.40	617.13					60,683.72	2,781.75	56,216.20	1,610.55	60,608.59		75.22	188,979	
April.....	46,068.56	1,352.13	1,219.32	7,513.21	535.48					56,688.70	1,657.55	53,267.35	1,454.16	56,319.06		369.64	176,527	
May.....	43,772.61	1,323.97	1,223.49	7,432.54	567.29					54,319.90	1,246.70	52,779.35	1,493.43	55,519.48	\$1,199.58		174,159	
June.....	41,161.03	1,269.02	1,267.25	7,202.48	559.73					51,459.51	1,230.50	48,979.70	1,380.81	51,591.01	131.50		160,943	
	551,979.98	14,596.30	14,279.39	87,054.53	6,972.55					674,882.75	19,200.98	624,050.20	19,546.20	662,797.38		12,085.37	2,075,335	
European laborers' messes.																		
1911—July.....	23,381.65	92.38	665.65	2,623.93	316.14	\$441.24	\$93.48	\$263.88	\$70.02	27,761.41		30,514.49	375.03	30,889.52	3,128.11			\$77,224
August.....	24,411.84	101.79	867.07	2,702.79	302.30	419.14	146.90	269.06	78.04	29,298.93		32,653.80	380.08	33,033.88	3,734.95			82,585
September.....	26,858.90	103.49	773.24	2,916.53	286.19	411.28	75.00	134.50	79.42	31,638.55		35,435.53	260.80	35,696.33	4,057.78			89,241
October.....	30,416.76	120.17	719.18	2,996.74	299.65	425.98	73.20	235.02	99.85	35,386.55		39,453.42	267.47	39,720.89	4,334.34			99,302
November.....	30,842.55	103.63	693.61	2,975.72	285.63	438.26	153.15	161.67	127.37	35,575.29		38,801.00	244.93	39,046.01	3,470.72			97,615
December.....	33,112.75	115.73	921.91	3,002.00	286.93	451.80	74.00	236.79	137.96	38,430.47		41,273.81	217.73	41,491.54	3,061.07			103,730
1912—January.....	33,030.66	115.92	1,012.05	3,152.73	303.30	447.81	80.30	513.83	11.07	38,667.67		41,577.61	228.40	41,806.01	3,138.34			104,515
February.....	28,715.33	99.41	737.87	3,181.17	290.28	446.24	79.20	412.78	7.56	33,969.84		36,713.79	266.93	36,920.72	2,950.88			92,302
March.....	29,820.15	121.08	737.97	2,945.52	295.97	442.03	79.50	273.34	105.46	34,821.52		38,162.16	187.73	38,349.89	3,528.37			95,875
April.....	28,893.40	119.73	784.71	3,187.48	278.63	437.25	79.10	419.96	125.92	34,326.18		36,137.19	167.33	36,304.52	1,978.34			90,761
May.....	28,130.33	107.42	793.10	3,102.15	332.07	441.09	77.90	350.64	80.11	33,414.81		35,798.05	198.13	35,996.18	2,581.37			89,990
June.....	26,572.34	103.69	835.13	2,932.67	266.80	440.28	79.10	205.45	87.03	31,522.49		33,782.66	231.34	34,014.00	2,491.51			85,035
	344,187.16	1,304.44	9,541.49	35,810.03	3,543.89	5,242.40	697.57	3,476.92	1,000.81	404,813.71		440,303.59	2,965.90	443,269.49	38,455.78			1,108,175
Common laborers' kitchens.																		
1911—July.....	8,339.80	28.07	227.43	763.67	31.07	150.75	122.11	32.13	5.50	9,556.31		9,058.98	1,422.09	10,481.07	924.76			38,819
August.....	10,634.88	30.42	349.31	954.64	46.19	172.85	46.10	21.53	9.09	12,265.01		12,244.55	1,480.95	13,725.50	1,460.49			50,835
September.....	12,498.49	34.36	317.20	1,097.24	71.09	180.71	21.50	18.89	6.54	14,246.02		14,156.30	1,587.78	15,744.08	1,498.06			58,311
October.....	12,733.57	35.70	280.32	1,184.05	61.23	166.01	18.40	37.97	5.54	14,522.79		13,694.01	1,851.12	15,545.13	1,022.34			57,575
November.....	11,240.22	26.89	241.25	1,125.37	61.01	153.73	17.90	26.96	4.48	12,862.01		12,068.64	1,444.86	13,513.50	651.49			54,650
December.....	10,662.83	27.56	286.09	993.29	55.24	140.19	17.60	23.94	3.60	12,210.34		11,822.75	1,098.36	12,921.11	710.77			47,858
1912—January.....	10,790.69	31.32	325.84	1,017.52	79.89	144.18	16.90	45.36	10.50	12,462.20		12,204.63	1,122.57	13,327.20	865.00			49,360
February.....	9,883.09	27.26	240.97	1,004.27	55.85	145.75	18.00	29.53	1.26	11,405.98		11,148.07	1,150.47	12,298.54	892.56			45,556
March.....	10,642.52	29.51	250.37	987.60	53.09	149.96	17.70	22.26	7.12	12,135.61		11,068.21	1,085.04	13,053.25	917.64			48,345
April.....	10,424.36	33.52	277.72	956.46	46.60	154.74	18.10	16.05	14.66	11,042.21		11,606.34	1,131.90	12,828.24	886.03			47,512
May.....	10,418.89	30.86	271.63	956.94	61.09	150.90	19.30	37.25	6.36	11,053.22		11,363.07	1,288.39	12,651.46	698.24			46,857
June.....	9,641.46	27.07	287.77	924.39	42.39	151.71	18.10	24.08	5.19	11,094.00		10,751.40	962.37	11,713.86	619.86			43,385
	127,910.80	362.54	3,355.90	11,965.44	664.74	1,861.48	171.09	283.27	79.84	146,555.70		142,177.04	15,625.90	157,802.94	11,147.24			584,457
Total.....	1,024,077.94	16,263.28	27,176.78	134,830.00	11,181.18	7,103.88	\$69.26	3,760.19	1,089.65	1,226,352.16	19,200.98	1,206,530.83	38,138.60	1,263,869.81	37,517.65		2,075,335	1,750,873

1 Credit: This amount, plus current month's charge, credited on previous charges by mechanical division.

2 Credit: This amount returned in excess of amount received.

APPENDIX L.

REPORT OF H. A. A. SMITH, EXAMINER OF ACCOUNTS.

ISTHMIAN CANAL COMMISSION,
Empire, Canal Zone, August 13, 1912.

SIR: I have the honor to submit the following report of the transactions of the department of examination of accounts, including the duties performed as auditor of the government of the Canal Zone for the fiscal year ended June 30, 1912.

The general character of the business of this office, as stated in my last annual report, has been continued with but little change during the year just closed. The arrangement of the force for the prompt and efficient handling of the business of the office has remained the same, and the organization whereby the several divisions, including general accounting, pay rolls, vouchers, coupon books and meal tickets, files and bonds, injury claims, contract laborers, time inspection, Canal Zone accounts, and inspections of accountable officers, have been maintained, each under the immediate supervision of a principal clerk, has further proven the most satisfactory method of handling the many details and subjects involved in the duties assigned to this department.

GENERAL ACCOUNTING.

In the division of general accounts, which includes the bookkeeping and the compilation of all financial data, the records of revenues collected, and bills against employees and others, the work has been kept nearer current than has heretofore been possible.

Under your direction the permanent record of classified expenditures for the construction of the canal has been changed, during the year just closed, by providing accounts to care for the department of law, terminal facilities at Cristobal and Balboa, lighting and buoys of the canal, inspection of lock gates, emergency dams, etc., armament of fortifications and Atlantic and Pacific seacoast batteries with their usual detailed distribution.

As a result of the establishment of the method of absorption of plant charges, started July 1, 1909, there has, up to June 30, 1912, been a total of \$25,226,779.74, carried into the classified accounts for the several units of the work, leaving a balance of \$3,590,949.49 in the plant accounts on June 30, 1912, as shown in Table 7, submitted herewith.

Table 6 is a statement of the proratable accounts of general administrative expenses and general expenses compiled in this office and distributed to expenditure accounts for canal construction, sanitation, and civil administration during the year on the authorized basis. Table 3 itemizes the various appropriations for the construction of the canal more in detail than those previously published. The

other tables of the financial operations of the commission are in line with and a continuation of those submitted with my preceding annual report.

In order to more clearly show the condition of appropriations by Congress and exhibit the available balances of same in detail, I have supplemented the general account, "Appropriations by Congress," by separating the account into several subheadings, as follows: (a) United States Treasury, (b) disbursing officer, Washington, (c) disbursing officer, Isthmus, and this has been further supplemented by maintaining a detailed appropriation ledger, which is kept current and as rapidly as possible is being completed for the earlier period of operations.

Upon the recommendation of this office it was decided not to reclassify the accounts during the year on the lines recommended for all Government departments by the Commission on Economy and Efficiency. The departments in Washington were not attempting to install the system immediately, and its installation on the Isthmus would have necessitated the keeping of two sets of accounts by the commission. A new system of accounting will be necessary when the operation of the canal commences, and its general outlines should be determined upon in less than a year. Then the essentials of the accounting system which during the present fiscal year is being installed throughout the Government service can readily be adopted for the canal. Every proper representation should therefore be made to prevent the radical departure involved in the installation of the accounting system approved by the Commission on Economy and Efficiency over the small remaining portion of the work of construction, which could prove of little benefit and would certainly result in confusion.

The financial accounts of employees charged with the duty of making collections or reporting charges for collections on account of the operation of hospitals, dispensaries, health offices, quarantine stations, etc., have been carefully audited. Bills against employees and outside parties for charges due the commission on account of services and material have increased during the past year, the monthly average being 490.

A systematic and exhaustive method is maintained to recover all moneys due the United States, and with the exception of a number of small hospital charges, no loss is sustained. To this division is also assigned the work of pay-roll analysis and the maintenance of a careful check of unpaid salaries and wages, which represents accounts earned by employees but for various reasons not collected. The balance in this account on June 30, 1912, amounted to \$238,634.02, which has been accumulating since the beginning of the work. This balance, however, includes the amount carried forward each month as unpaid, on account of pay receipts not presented, representing about 25 per cent of the total, and which is usually paid during the following month.

Under the revised agreement with the Republic of Panama, which provides for the construction and maintenance of waterworks, sewers, and pavements within the cities of Panama and Colon, and for the reimbursement of such expenditures to the United States, there has been expended \$1,562,144.51 in the city of Panama and \$1,386,696.13 in the city of Colon, a total of \$2,948,840.64, which

includes accrued interest to date at the rate of 2 per cent per annum on capital cost balances amounting to \$130,033.83 for work in Panama and \$89,130.09 for work in Colon. During the same period \$757,025.76 has been reimbursed, leaving a balance due the United States of \$2,191,814.88. Included in the above reimbursed amount is \$27,830.51, which represents the value of water used by the Isthmian Canal Commission in the two cities.

COUPON BOOKS AND MEAL TICKETS.

The duties and methods of handling the accounts for the issue of commissary and hotel coupon books and meal tickets of European and colored laborers continued throughout the past year, and necessitated a close observation of reports of issuing clerks and stewards of hotels, messes, and kitchens. There are 49 bonded employees who are engaged exclusively or partially in issuing coupon books and meal tickets. During the year 718 requisitions calling for 593,900 coupon books and over 1,700,000 meal tickets have been filled and proper collections or accounting made therefor. This involves the monthly audit of the reports of all employees charged with the responsibility of issuing books and tickets, and making the proper charge therefor against employees. Tables 14 and 15, herewith submitted, show in detail the volume of business pertaining to coupon books and meal tickets.

On June 1, 1912, the method of selling commissary books for cash by the commissary department of the Panama Railroad Co. was installed at several points as an addition to the existing practice of issuing books for payment by pay-roll deduction. This practice has served to reduce to some extent the work of issuing clerks and increases the volume of business in the commissaries during the first four and last two days of each month, during which period the issue of books has heretofore been prohibited. The additional method of issue will have practically no effect on the work of this office. The changes in issue and accounting for coupon books approved by your Circular 256-F, which became effective July 1, 1912, will operate principally to remove a number of restrictions on book issues heretofore existing, and it will serve to simplify to a considerable extent the work of issuing clerks, as well as increasing the convenience to employees by permitting the issue of books every working day where such issue is practical. That circular also provides for the transfer to the Panama Railroad Co., as of July 1, 1912, the duties of purchasing and issuing commissary coupon books to issuing clerks. This has been accomplished and an agreement has been reached whereby that company will reimburse the commission for a reasonable proportion of the expenses incurred in the work of issuing and accounting for commissary books.

I am of the opinion that the volume of work necessitated by the present method of handling coupon books can be further reduced by the elimination of hotel books, and the acceptance of commissary coupons in payment of meals at all hotels, payment being made to the subsistence department of the commission, by a monthly bill against the Panama Railroad Co., supported by the commissary coupons accepted by the hotels in payment of meals served. During the year \$3,123,220.96, has been paid the railroad company on

account of commissary coupon books issued and collected for by the commission, by deduction from employees salaries. This includes a small amount of cash collected on account of authorized cash sales.

DIVISION OF GENERAL INSPECTION.

The accounts of all bonded employees charged with the collection of commission or Canal Zone government revenue have been inspected at frequent and irregular periods as in the past. There are now 165 accounts of such employees who are financially responsible and on account of which 827 inspections were made during the year, embracing financial accounts, coupon book accounts, and other miscellaneous revenue accounts.

I have during the past year instituted a more complete and detailed checking of the accounts of post offices, hospitals, and the Tivoli Hotel, which appeared to me to be necessary in view of the great and increasing volume of business and the installation of the postal-savings system. An extra man has been detailed to this work during the past year, making a total of four instead of three, who were assigned to these duties during the prior year. The work constitutes a very important part of the duties of this office and in connection with the regular monthly reports rendered by all financially responsible employees, is the greatest factor in keeping at a minimum any petty misappropriations of Government funds, or errors in the accurate accounting for all money or money values for which they may be responsible. There has been one small defalcation during the year for which complete restitution has been accomplished.

VOUCHER DIVISION.

There has been some increase in the number of claims audited and vouchers prepared during the year just closed. A total of 3,440 vouchers have been prepared and recommended for payment, involving disbursements to the amount of \$10,440,047.25, of which over \$9,000,000 represents payments to the Panama Railroad Co. on account of material and service furnished the commission and commissary coupon books furnished its employees, the latter amounting to over \$3,000,000. The increase in the number of settlements is principally due to numerous payments to landowners and others within the region to be occupied by Gatun Lake. At the close of the year there were on hand unsettled claims amounting to \$114,176.99, of which \$41,069.94 were in favor of the Panama Railroad Co., and the balance of \$73,107.05 includes several large claims for land purchased but not yet completed for payment.

Some improvement has been made in handling accounts between the Panama Railroad Co. and the commission, resulting in securing a settlement of the accounts of both interests more promptly.

The administrative examination of the disbursing officers monthly account has been made as required, and the accounts forwarded to the Auditor for the War Department at Washington. This administrative audit is considerably simplified by existing regulations of the commission, whereby vouchers for disbursement are audited by this office prior to payment, the greater part of the work being confined to examination of receipts of employees for salaries and wages. In

passing pay rolls and other vouchers for disbursement during the past fiscal year this office has increased its effort to maintain a careful compliance with the requirements of the United States Treasury accounting officials at Washington, the good result of which is shown by fewer suspensions of commission disbursements by the Auditor for the War Department than in prior years.

The action of the House in amending the legislative, executive, and judicial appropriation act for the fiscal year 1913 so as to provide that "all vouchers and pay rolls shall be prepared and examined by and through the administrative heads of divisions and bureaus in the executive departments, and not by the disbursing clerks of said departments," places legislative approval upon your course in reorganizing the accounting and disbursing departments on the Isthmus in October, 1908. This provision has been approved by the conference committee and will undoubtedly be enacted a law. The officer responsible for the safekeeping of Government money should not have charge of the accounting work of the Government. The results of the change in organization has fully justified it.

PAY-ROLL DIVISION.

The largest division within this office is the one to which is assigned the duty of auditing the pay rolls of the commission, and the maintenance of the personnel file of gold employees. During the past year there has been an average of fourteen men engaged in this work supplemented during the first few days of each month by employees of the office usually assigned to other duties. The work and responsibility involved in checking pay rolls is very great and includes the verification of the amount paid to each employee and the careful examination of the deductions made on account of amounts due the United States, or the Panama Railroad Co., on account of hotel, mess, and kitchen subsistence and coupon books furnished employees during the month; medical and hospital charges; lost or destroyed property; dental charges; clubhouse dues; transportation charges; corral bills and other miscellaneous collections. There are now 121 pay rolls each month, carrying in the aggregate over 36,000 payments, there being numerous instances where more than one payment is made to an individual on account of his transfer to one or more different parts of the work within a month, involving approximate monthly disbursements of \$1,500,000.

To this division is also assigned the duty of examining recommendations for meritorious sick leave which, during the year just closed, has totaled 5,141 cases and resulted in payments amounting to \$55,838.25. The employees of this office engaged on pay-roll work are also charged with the duty of making a monthly check of the time books and time rolls in the various time-keeping offices throughout the work, for the purpose of verifying the time allowed each employee and to see that they are properly charged by the necessary deduction for their unauthorized absence, and that proper adjustment is made for any errors in time-keeping which may have reached the pay roll. In addition to the regular work, there have been a number of miscellaneous statements and compilations made with reference to employees by classes, rates of pay, etc., also a monthly comparative statement of errors found on pay rolls, a copy of which is furnished

each department and division, and has resulted in much good in the form of increased accuracy in compiling pay rolls.

The value of the book of time-keeping rules, issued September 1, 1910, has continued to increase as time keepers and others engaged in keeping time or making pay rolls have become more familiar with the rules and regulations relative thereto, and has resulted in a uniformity of methods and a general improvement in the form of pay rolls that did not appear to be possible under the old system, whereby each office maintained a more or less incomplete file of circulars pertaining to time keeping and pay rolls.

DIVISION OF TIME INSPECTION.

The work of the time-inspection division has been continued uniformly with that of several preceding years. On account of the cessation of work at some points and its concentration at others, it has been found advisable to reduce the districts to three instead of four, the senior inspectors being located at Ancon, Empire, and Gatun, and a reduction of the force of inspectors from 46 to 42 accomplished without detriment to the work. There has been a marked decrease in the number of cases of improper designation of employees, misuse of Government material and labor, and incorrect entries of time during the fiscal year just closed.

The work of time inspection has probably been more effective during the past year than at any prior time, and this is principally due to a better understanding of the work by foremen and others in charge, whereby they have been enabled to work in accord with each other and a corresponding increase of cooperation has been brought about, resulting in a greater benefit to the service generally. This has caused a considerable decrease in the reports to your office on account of the action by the heads of departments and divisions, and their assistants, in promptly making the necessary corrections of such irregularities as may be brought to their attention.

SCHEDULE BOND OF EMPLOYEES.

Effective November 1, 1909, the Illinois Surety Co. executed a schedule bond covering employees of the Isthmian Canal Commission and Canal Zone government who were required to give bond under the regulations of the commission, with the understanding that the bond was to run for a period of three years. In order to avoid the difficulties incident to a change in surety companies just as the canal work is being completed, arrangements have been made with the surety company to continue the bond in effect from year to year from July 1, 1912, at the rate heretofore paid, \$3 per thousand. For the 326 employees of the commission, covered by this bond at the time of this writing, the total liability of the surety company is \$510,000. On this amount the premiums annually paid by employees would be \$1,530. The actual amount received by the surety company to compensate it for its liability during the fiscal year 1912 was \$1,605.

CONTRACT LABORERS.

The financial accounts and personnel identification records of European and other contract laborers, also of the preferred class of laborers other than those whose original employment was made by

contract, being recruited by agents of the commission has been continued during the year without change. The trafficking in and transfer between laborers of their registered identity and metal checks has been greatly reduced during the past year, there being but few instances where imposters have obtained the higher rate authorized for contract laborers or others.

The usual verification of the cash balance in the hands of the disbursing officer has been made. The transfers of cash and cash values between the disbursing officer and his assistant, necessitated by the absence of the former, were witnessed by this office on September 1 and November 1, 1911, and a complete check of his office, including a count of all cash on hand, was made on December 15, 1911.

ACCOUNTS OF CANAL ZONE GOVERNMENT.

The duties required of me as auditor of government of the Canal Zone have been continued during the past year, practically the same as stated in my last annual report. In such capacity I am charged with the duty of receiving, examining, and settling all accounts pertaining to the revenues of the Canal Zone government, and expenditures therefrom. This embraces nearly 600 monthly accounts, including those of the treasurer, collector of revenues and deputies, court clerks, judges, marshals, clubhouse secretaries, and other miscellaneous accounts.

Tables 21 and 22 hereto appended are statements of revenues and expenditures of Canal Zone funds during the past fiscal year, and show the total revenues of \$370,272.81, and expenditures, \$312,459.75. The increase in expenditures during the fiscal year just ended is principally due to the increase in construction and maintenance of roads and trails and the payment made steamship companies on account of ocean transportation of mails covering the period from 1905 to the present time. While by the method of stating the revenues for liquor licenses in the current statement a part of this year's revenues has been omitted, by having them collected and reported during the latter part of June, yet there has been a considerable actual falling off in revenues from this source on account of the reduced number of saloons in abandoned districts and this, together with reduced revenues for land rentals and interest on deposited funds, accounts for the greater portion of the falling off of Canal Zone revenues during the past year, and which it can be anticipated will continue as other towns are abandoned along the line, thereby reducing the revenues obtained by taxation and rentals.

Tables 19 and 20 are statements of receipts and expenditures of Canal Zone funds from the beginning of the work to June 30, 1912. These have not heretofore been published, as considerable difficulty was encountered going over the old records available in order to properly classify the receipts and expenditures for the early period in accordance with the classification now in use.

This statement should not, however, be construed as covering all expenditures on account of the local government since American occupation. Until the administrative districts were established by the Executive order of the President of March 13, 1907, which became effective April 15, 1907, the municipalities continued in existence, levied and collected taxes and made expenditures for salaries of municipal officers and for municipal improvements. The accounts

for these receipts and expenditures have never come within the jurisdiction of the auditor.

During the year there have been 769 claims presented against the Canal Zone government, and 549 settlements issued for payment by the treasurer, involving 745 claims, leaving 24 claims on hand and unsettled on June 30, 1912. Table 23 is a statement of balance of Canal Zone funds on hand at the close of business June 30, 1912. The major portion of the funds are kept in two depositories at Washington; a small balance for checking purposes is carried in a depository on the Isthmus, and the treasurer keeps in his possession a small amount of cash. The safe-keeping of funds deposited in bank in Washington and on the Isthmus is secured by the deposits with a representative of the Government of bonds of the highest grade with a market value considerably in excess of the amount of funds on deposit. During the past year the average monthly balance at Washington has been \$1,121,707.64 and that on deposit on the Isthmus, \$43,625.73, from which the revenue derived as interest has amounted to \$20,784.96.

CLUBHOUSES.

The accounts of the several clubhouses have been audited monthly. The greater portion of the expenditures from clubhouse funds are paid by the treasurer on vouchers audited and approved by this office. This arrangement has been a considerable improvement over the former method whereby the secretaries or superintendent disbursed these funds, and has resulted in greatly reducing the cash balances in the hands of secretaries. During the past year the receipts from the operation of clubhouses has amounted to \$118,390.56, and the disbursements \$114,732.02. The accumulated balance on hand June 30, 1912, was \$24,853.74, of which \$22,389.57 is held by the treasurer of the Canal Zone, and the balance of \$2,464.17 in the hands of secretaries.

POST OFFICES.

The work of auditing postmasters' weekly and monthly reports has been considerably increased, due principally to the desire of this office to maintain a more detailed check of postal operations than has heretofore been possible with the force assigned to inspection of fiscal accounts. Under the order of the President, dated September 8, 1911, establishing the postal-savings system in the Canal Zone, the operation of that branch of the service was started on February 1, 1912. Table 25, appended hereto, shows the business transacted during the five months of its existence, with deposits amounting to \$609,906, involving the issue of 17,593 postal-savings certificates, of which \$252,959 has been withdrawn, leaving a balance in postal-savings funds as of June 30, 1912, of \$356,947. The postal-savings bank funds are deposited with the treasurer and are included by him in his general balance deposited with the regular depositories of Canal Zone funds. The provisions of the contracts with these depositories entered into by or with the approval of the Secretary of War were found to be broad enough to make it unnecessary to provide separate arrangements for the investment.

Tables 24, 25, and 26 show the transactions of the Canal Zone postal service during the year. There were 227,707 money orders issued in the Canal Zone for \$4,915,077.26, which shows an increase

in the number of orders issued and a decrease in the amount of money, but this is more than offset by the transactions of the postal-savings system, as employees who heretofore purchased money orders drawn on the Canal Zone and in favor of themselves now take out certificates of deposit under the postal-savings system. The total business shows a considerable increase over the preceding year. The volume of the money-order business is shown by the 49,148 money orders paid by the United States during April, May, and June and received from the Auditor for the Post Office Department in Washington within the last few days. The amount involved was \$979,619.53. The total amount of money orders issued since their sale commenced in 1906 is \$27,671,003.39. The paid orders have amounted to \$26,042,021.03. A very small number of orders have been issued on Martinique and Costa Rica.

Stamp sales have amounted to \$87,641.45, which is also an increase over last year. In accordance with the order of the Secretary of War, dated December 3, 1904, which provides that the authorities of the Canal Zone shall purchase from the Republic of Panama such stamps as the authorities of the Canal Zone desire to use in the Canal Zone at 40 per cent of their face value, there has been paid to the Republic of Panama on account of stamp purchases made to June 30, 1912, on the above basis, \$206,567.02. In this connection I desire to renew the recommendation contained in my last annual report that negotiations be entered into with a view of discontinuing the arrangement in order that the Canal Zone government may be relieved of further payments of this kind.

CLAIMS FOR INJURY AND DEATH.

Under the provisions of the injury-compensation act of May 30, 1908, as amended by section 5 of the act of March 4, 1911, 1,849 claims for compensation on account of injuries received in the course of employment were filed by employees during the fiscal year, and 50 claims were filed on account of deaths, a total of 1,899. Compared with this total are the 1,619 claims for the previous year, 1,199 for the year ended June 30, 1910, and 703 for the period August 1, 1908, to June 30, 1909. This increase during the last year is not excessive, in view of the extension of the benefits of the original act to all employees of the commission by the amendment contained in section 5 of the act of March 4, 1911, 1,410 injury claims and 31 claims on account of death were allowed; 167 injury claims and 18 death claims were disapproved. Further details in regard to the number of claims filed and the amounts paid can be found in Tables 16 and 17 attached hereto.

Every person who is injured and is found in the hospitals is given an opportunity to file a claim with the claim officer. This course, while a decided benefit to the employees, also affords opportunity for filing claims that are without merit. The result is that a number of claims are necessarily disapproved. The careful scrutiny given these claims and the supporting evidence prevents almost without exception allowance of any but legitimate claims. During the past year there has been only one case in which a claimant was prosecuted for filing a fraudulent claim. In that case the evidence adduced at the trial was held insufficient to justify conviction, although subsequent developments proved conclusively that the claim was fraudulent.

Sixty-seven injury claims were disapproved because the evidence was not considered sufficient to establish the happening of an accident in course of employment; in 21 cases it was held that the injuries were not received in course of employment; in 19 cases the employees were charged with negligence or misconduct; in 31 cases the incapacity did not appear to have been caused by the injury for which compensation was claimed; and in 24 cases the incapacity was due to illness and not to an injury received in course of employment. Of the 18 death claims not allowed, 10 were disapproved because the claimants were not dependent parents within the meaning of the act; in 4 cases the employees were charged with negligence or misconduct; and in 3 the employees did not die as the result of an injury received in course of employment, and in 1 case the death of the employee was caused by illness and not by injury.

In addition to the claims arising under the general compensation act the chairman granted meritorious sick leave on account of injuries received in course of employment in 5,141 cases, under the act of February 24, 1909. These were cases in which disability has primarily continued for less than 15 days. The average period of disability in these cases is estimated as 5 days, whereas the average period of disability of employees for whom claims are made under the general act was 45 days. Payments were made during the fiscal year as follows:

On account of injury claims.....	\$166, 620. 21
On account of death claims.....	37, 534. 68
On account of grants of meritorious sick leave under the act of Feb. 24, 1909.....	55, 838. 25
A total for the year of.....	259, 993. 14

From the effective date of the act of May 30, 1908—that is, from August 1, 1908, to June 30, 1912—the Isthmian Canal Commission has paid \$691,753.07 on account of injuries received by employees in course of employment.

The experience of the last year has tended to confirm the opinion of this office that better results, both to the commission and to employees, have been the result of having injury claims passed upon by the chairman of the commission instead of the Secretary of Commerce and Labor. There is less delay in making settlement; it is less difficult to prepare the evidence for consideration; the chairman is in a better position to weigh the available evidence and to give proper consideration to the surrounding circumstances. In two or three bills that have been considered by Congress at the present session there have been provisions taking away from the chairman the authority to settle claims. In each case it has been urgently recommended by this office that every proper step be taken to prevent the passage of such legislation. One bill radically changed the basis of payment. In cases of permanent disability that bill proposed to allow for a period of years the total salary or wage of the employee up to \$25 per month, and from that point one-half the salary, not to exceed \$600 per year. On account of the great number of alien laborers receiving 10, 13, 16, and 20 cents per hour, it is not believed that this is the proper basis for making payments in cases arising under conditions existing on the Isthmus. The proposed legislation favored the aliens as against the American employees. Any legislation in regard to injury claims of employees in

the United States should take into consideration the special conditions under which the canal is being constructed and will have to be operated, and the classes employed upon the canal work. In the same manner any general legislation providing for the retirement of Government employees should not be passed without making special provisions for the conditions existing on the Isthmus of Panama.

Detailed statistical tables giving causes of accident producing disability, and as to ages, color, and nationality of employees injured have not been prepared by this office, but all information of this character which has been requested by the Department of Commerce and Labor has been furnished in accordance with your instructions. That department should be able to make the same analyses of Isthmian cases it now makes of the cases settled directly by the Secretary of Commerce and Labor. The furnishing of this data by the commission entirely defeats the claim that the Department of Commerce and Labor must have sole jurisdiction of injury cases in order that its records may be complete and its statistics on the subject be available for the use of all.

ACCOUNTING SYSTEM OF THE COMMISSION.

The experience with the accounting work of the commission gained during the last few years has convinced me of the necessity of a centralized accounting organization. At the present time there are almost insurmountable difficulties in getting data along certain lines of inquiry that have been made. This is due to the fact that some of the accounting is done in the States with no effective control provided for in this office; that the cost keeping is handled independently of the general accounts, and that some of the essential accounting is carried on in the Quartermaster's Department and elsewhere, so that in no one place is complete information accessible. The reason for calling attention to this matter at this time is for the purpose of pointing out the absolute necessity of centralizing all accounting, cost keeping, and similar work in one office and under the control of one person, who can be held strictly responsible for results when the operating organization is established within the near future.

PERSONNEL.

At the beginning of the year the authorized force of this department was 119 employees, including messengers. At the close of the year the authorized force was reduced to 111. This reduction has been in part due to the consolidation of certain parts of the work in the construction divisions and in part at least to increased efficiency in handling the work of the office. There have also been a number of changes in the personnel and a number of vacancies in positions now exist, which it has been found very difficult to fill from the Isthmus, there being a decided tendency on the part of employees engaged in clerical work to accept positions in the States whenever opportunity has been offered them.

The total authorized pay roll June 30, 1912, amounted to \$184,560. The pay-roll expenditures for the fiscal year were \$170,912.76, to which should be added the amount paid as injury compensation, \$626.88, making the total expenditures of this office for salaries and wages \$171,539.64.

No greater number of persons were employed by this department during the fiscal year 1912 than the number specified in the notes submitted in connection with the estimates for said year. A greater rate of compensation has been paid to two employees during a part of the fiscal year than the rate authorized to be paid on the 1st day of July, 1910. Section 5 of the act of March 4, 1911, transferred from the Secretary of Commerce and Labor to the chairman of the commission jurisdiction to settle claims arising under the injured employees' compensation act of May 30, 1908. The salaries of the claim officer and one clerk in charge of injury-claim work were increased from \$2,400 to \$2,700 and \$1,800 to \$2,100, respectively, on account of increased duties and responsibilities devolving upon them, as shown in Table 27.

CANAL APPROPRIATIONS AND EXPENDITURES.

Congress has appropriated \$296,566,928.76 on account of the canal work. Of this amount \$3,000,000 was appropriated for fortifications and \$5,460.18 was appropriated for the relief of private persons. The total chargeable against the authorized bond issue is therefore \$293,561,468.58. Five million eight hundred and fifty-six thousand four hundred and twenty-six dollars and seventy-seven cents was collected and returned to the Treasury as "miscellaneous receipts" to June 30, 1912. This item represents the total amount appropriated by Congress, which, after being used for miscellaneous purposes in connection with canal work, has been covered back into the Treasury and lost to canal appropriations. This amount includes the payments made by the Panama Railroad Co. on account of loans, \$1,687,714.92; interest on the loans, \$473,194.27; annual subsidy, \$631,875; and dividends, \$344,945—a total of \$3,137,729.19. There will probably be a difference of opinion as to whether all of these items should be considered as paid from appropriations made by Congress. The payment of this money into the Treasury of the United States, however, rendered it impossible for the railroad company in the early days to renew its roadbed and equipment, necessitated the use of moneys appropriated by Congress directly for rebuilding and reequipping the railroad and required the commission to pay such amount for material sold and services rendered as would insure the company's having a profit to use for purposes of this character. This amount should be deducted from the total appropriations in order to ascertain the net amount available for actual canal purposes.

Table 1 shows the total amount which has been made available for canal purposes as \$287,705,041.81. In addition to this amount, the commission has received some benefit from moneys collected, which it was expected, when the original estimates were made for the construction of the canal, would be covered into the Treasury as "miscellaneous receipts." There are only two appreciable items of this kind, besides whatever profits may have been made in the operations of the commission—that is, in making sales of material to and rendering services for outside parties. The two items from which the commission has obtained money for its use, which was not expected when the estimates of 1908 were made, are the water rentals paid by the Republic of Panama as a repayment of the amount expended in installing waterworks and sewers in the cities of Panama and Colon

and the net receipts from the sale of scrap. To June 30 the commission has had the use of \$625,654.54 received as water rentals, \$67,492.60 received from the sales of French scrap; and \$98,605.75 received from the sale of American scrap—a total of \$791,752.89. During the fiscal years of 1909, 1910, and 1911 rentals were paid by the Panama Railroad Co. for use of the steamers *Panama* and *Colon*, but the commission paid the repairs on these vessels and had to pay higher freight rates, in order that the rentals might be paid. It is not seen, therefore, how the commission could have obtained any additional money from this source. It is probable that certain profits have been made from sales of material and rendition of service, but the items are limited solely to the transactions with outside parties, which have been small, and the amount of any profit has been inappreciable. Based upon the method of keeping the records, profits have arisen from the operation of the hotels, messes, and kitchens, but I do not believe the items thus shown should be considered as having increased the money available for canal purposes. The addition of the \$791,752.89 to the \$287,705,041.81 should therefore represent the total amount up to June 30, 1912, which was made available to the commission for regular canal work.

The total appropriations for continuing the construction of the canal during the fiscal year 1913 will probably be \$29,083,520 for canal work proper and \$2,806,950 for fortifications, these being the amounts carried in the bill as it passed the Senate, the only difference being the increase in the items for the department of civil administration, made in the Senate to cover the expenses of the police division of that department.

Respectfully,

H. A. A. SMITH,
Examiner of Accounts.

Col. GEO. W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

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TABLE 1.—*Statement of moneys available for and applied to the purchase of canal rights and cost of canal construction to June 30, 1912.*

Appropriations by Congress (Table 3).....		\$296, 566, 928. 76
Less:		
Armament of fortifications.....	\$1, 000, 000. 00	
Seacoast batteries.....	2, 000, 000. 00	
Private acts.....	5, 460. 18	
Collections returned to the United States Treasury as miscellaneous receipts, and lost to canal appropriations (Table 4).....	5, 856, 426. 77	
		<u>8, 861, 886. 95</u>
Net amount available.....		<u>287, 705, 041. 81</u>
Classified expenditures (Table 5).....		260, 866, 118. 40
Less unapplied credits to expenditures:		
Water rentals.....	757, 025. 76	
French scrap used or sold.....	1, 136, 958. 45	
Unpaid rolls on June 30, 1912....	\$1, 856, 938. 24	
Less unpaid amounts on rolls for seacoast batteries.....	49, 767. 07	
		<u>1, 807, 171. 17</u>
Subsidies from Panama R. R. Co.....	631, 875. 00	
Dividends from Panama R. R. stock.....	344, 945. 00	
Interest on loans to Panama R. R. Co.....	473, 194. 27	
Miscellaneous rentals.....	238, 650. 08	
		<u>5, 389, 819. 73</u>
Net charges to classified expenditures.....		255, 476, 298. 67
Material and supplies and other unclassified items (Table 2), less \$1,218,341.84 for fortifications and private acts.....		4, 643, 028. 32
Bills collectible outstanding (Table 2).....		541, 232. 17
Due on Treasury Department transfers from fortifications and seacoast batteries.....		196, 510. 70
Unexpended appropriation balances (Table 8) except \$2,033,396.11 for fortifications and seacoast batteries.....		26, 655, 619. 76
Collections returnable to appropriations (Table 10), \$193,941.06, less \$1,588.87 due Panama R. R. Co. from collections returned to appropriations.....		<u>192, 352. 19</u>
Total accounted for.....		<u>287, 705, 041. 81</u>

TABLE 2.—*Statement of receipts, disbursements, and balances available June 30, 1912.*

RECEIPTS.	
Appropriations by Congress (Table 3).....	\$296,566,928.76
Water rentals, Panama and Colon.....	757,025.76
Salvage from French material and equipment.....	1,136,958.45
Collections account of sale of Government property, etc. (Table 4)..<	5,856,426.77
Collections due individuals and companies.....	19,434.89
Total receipts.....	304,336,774.63
DISBURSEMENTS.	
Classified expenditures (Table 5).....	260,866,118.40
Department of civil administration.....	\$5,711,919.67
Department of law.....	24,729.16
Department of sanitation.....	14,814,763.97
Hospitals and asylums.....	\$7,535,211.92
Sanitation.....	6,108,217.97
Construction and repair of buildings.....	1,111,334.08
Department of construction and engineering... ..	152,298,242.76
Atlantic division.....	43,872,646.71
Central division.....	76,564,072.56
Pacific division.....	31,711,294.95
Lighting and buoying the canal.....	150,228.54
General items.....	86,803,581.18
Fortifications.....	1,212,881.66
Paid into the United States Treasury for sales of Government prop- erty, etc.....	5,856,426.77
Services rendered and material sold individuals and companies.....	4,167,762.42
Unclassified expenditures.....	5,861,370.16
Material and supplies.....	\$5,480,821.87
Other unclassified items, including suspense ac- counts for Colon, Ancon-Sosa, and Balboa fills, \$308,028.23; shop expense balances and June overhead expenses awaiting distribu- tion by divisions, less salvage on American scrap.....	380,548.29
Bills collectible outstanding.....	541,232.17
Total disbursements.....	277,292,909.92
Less amounts included above but unpaid on June 30, 1912.....	1,856,938.24
Salaries and wages unpaid on rolls to June 1, 1912.....	238,634.02
Pay rolls for the month of June, 1912.....	1,618,304.22
Net disbursements.....	275,435,971.68
Balances available June 30, 1912.....	28,900,802.95
Congressional appropriations (Table 8).....	28,689,015.87
June, 1912, collections returnable to appropria- tions (Table 10).....	193,941.06
Collections account of individuals and compa- nies.....	17,846.02
Due individuals and com- panies.....	19,434.89
Less amounts due Panama R. R. Co. from collections repaid appropriations.....	1,588.87
Total accounted for.....	304,336,774.63

TABLE 3.—Statement of appropriations by Congress.

	Total.	Act of June 30, 1906 (f. y. 1907).	Acts of Mar. 4, 1907, and Feb. 15 1908 (f. y. 1908).	Acts of May 27, 1908, and Mar. 4, 1909 (f. y. 1909).	Acts of Mar. 4, 1909, and Feb. 25, 1910 (f. y. 1910).	Act of June 25, 1910 (f. y. 1911).	Act of Mar. 4, 1911 (f. y. 1912).
Canal rights from French company (act of June 28, 1902).....	\$40,000,000.00						
Canal Zone rights from Republic of Panama (act of Apr. 28, 1904).....	10,000,000.00						
Canal connecting Atlantic and Pacific Oceans (acts of June 28, 1902, and Dec. 21, 1905).....	10,000,000.00						
Deficiency for fiscal year 1906 (act of Feb. 27, 1906):.....	11,000,000.00						
Miscellaneous material purchases in the United States.....	1,000,000.00						
Miscellaneous material purchases on the Isthmus.....	400,000.00						
Payments to Panama R. R. Co.....	200,000.00						
Isthmus pay rolls.....	2,100,000.00						
Salaries and services in the United States.....	75,000.00						
New equipment purchases.....	1,565,786.00						
Reequipment of Panama R. R.....	650,000.00						
Total for purchase of rights and for lump-sum appropri- ations common to all departments.....	76,990,786.00						
Expenses in the United States:	1,022,663.33	\$251,063.33	\$202,600.00	\$149,000.00	\$150,000.00	\$140,000.00	\$130,000.00
Salaries.....	408,179.36	117,179.36	69,000.00	27,000.00	75,000.00	70,000.00	50,000.00
Incidental expenses.....							
Construction and engineering:	21,304,212.00	2,650,512.00	2,982,700.00	4,000,000.00	3,871,000.00	3,900,000.00	3,900,000.00
Pay of officers and employees.....	75,434,961.00	9,050,661.00	13,526,300.00	10,858,000.00	12,000,000.00	13,500,000.00	16,500,000.00
Pay of skilled and unskilled laborers.....	83,881,514.24	9,032,814.24	15,131,700.00	15,200,000.00	10,517,000.00	15,000,000.00	19,000,000.00
Miscellaneous material purchases, etc.....							
Incidental expenses on Isthmus.....	4,400,250.00	434,550.00	715,700.00	400,000.00	1,000,000.00	900,000.00	950,000.00
Civil administration:	3,007,000.00	600,000.00	486,000.00	225,000.00	546,000.00	600,000.00	550,000.00
Pay of officers and employees.....	176,000.00	50,000.00	50,000.00	16,000.00	20,000.00	20,000.00	20,000.00
Pay of skilled and unskilled laborers.....							
Material and expenses.....	957,200.00	318,200.00	289,000.00		140,000.00	100,000.00	110,000.00
Sanitary department:							
Pay of officers and employees.....	3,941,000.00	550,000.00	766,000.00	700,000.00	725,000.00	600,000.00	600,000.00
Pay of skilled and unskilled laborers.....	2,566,968.00	579,068.00	637,900.00	500,000.00	450,000.00	200,000.00	200,000.00
Material and expenses.....	4,287,367.15	822,367.15	800,000.00	375,000.00	740,000.00	750,000.00	800,000.00
Reequipment of Panama R. R.....	4,185,000.00	1,000,000.00	1,385,000.00	1,100,000.00	700,000.00		
Relocation of Panama R. R.....	7,815,000.00			1,085,000.00	1,980,000.00	2,000,000.00	2,750,000.00
Redemption of first-mortgage bonds of Panama R. R. Co.....	2,298,367.50		2,298,367.50				
Sanitation in the cities of Panama and Colon.....	800,000.00				800,000.00		
Survey of lands, Canal Zone.....	75,000.00						
Relief of P. B. Benton for injuries.....	10,000.00			10,000.00		75,000.00	
Total regular fiscal year appropriations.....	198,857,782.58	25,456,415.08	27,161,367.50	29,187,000.00	33,638,000.00	37,855,000.00	45,560,000.00
Total deficiency appropriations.....	17,712,900.00		12,178,900.00	5,458,000.00	76,000.00		
Total lump-sum appropriations.....	76,990,786.00						

Total for canal construction to June 30, 1912.....	293,561,468.58				
Fortifications:					
Armament of fortifications.....	1,000,000.00				1,000,000.00
Seacoast batteries.....	2,000,000.00				2,000,000.00
Private acts for relief of—					
Elizabeth G. Martin, June 17, 1910.....	1,200.00		1,200.00		
Marcellus Troxell, Jan. 13, 1911.....	1,500.00				1,500.00
W. L. Miles, Feb. 13, 1911.....	1,704.18				1,704.18
Chas. A. Caswell, Mar. 2, 1911.....	1,056.00				1,056.00
Total appropriations by Congress to June 30, 1912.....	296,566,928.76				

NOTE.—The appropriations made primarily for fiscal years were made available until expended, and for 1912 were made immediately available.

By an act approved August 24, 1912, the following appropriations were made available for canal purposes:

In the United States:		Fortifications:	
Salaries.....	\$150,000.00	Surveys.....	\$50,000.00
Incidental expenses.....	50,000.00	Causeways.....	150,000.00
Construction and engineering:		Seacoast batteries.....	1,000,000.00
Pay of officers and employees.....	3,000,000.0	Submarine mine structures.....	220,200.00
Pay of skilled and unskilled laborers.....	11,000,000.00	Field fortifications and camps.....	200,000.00
Miscellaneous material purchases, etc.....	12,000,000.00	Armament of fortifications.....	500,000.00
Incidental expenses on Isthmus.....	750,000.00	Manufacture and test of ammunition.....	575,000.00
Civil administration:		Submarine mines.....	111,750.00
Pay of officers and employees.....	500,000.00	Total for fortifications, fiscal year 1913.....	2,806,950.00
Pay of skilled and unskilled laborers.....	15,000.00		
Material and expenses.....	75,000.00		
Sanitary department:			
Pay of officers and employees.....	700,000.00		
Pay of skilled and unskilled laborers.....	200,000.00		
Material and expenses.....	500,000.00		
Total for canal work, fiscal year 1913.....	28,980,000.00		

TABLE 4.—*Detailed statement of collections which have been deposited in the United States Treasury as miscellaneous receipts and lost to canal appropriations to June 30, 1912.*

Sales of Isthmian Canal property.....		\$1, 085, 463. 03
Sale of property.....	\$850, 500. 11	
Sale of French material and equipment.....	81, 634. 80	
Sale of water.....	255. 43	
Sale of Panama R. R. stock.....	1, 300. 00	
Mess accounts.....	46, 879. 48	
Receipts from pay patients.....	79, 992. 68	
Quarantine subsistence.....	24, 900. 53	
Rentals of Isthmian Canal property.....		521, 441. 02
Rent of lands and buildings.....	41, 427. 24	
Rent of equipment.....	311, 047. 33	
Panama water and sewer rentals.....	71, 967. 71	
Colon water and sewer rentals.....	31, 573. 00	
Rentals, miscellaneous.....	65, 425. 74	
Work done by Isthmian Canal Commission.....		207, 786. 52
Labor furnished Panama R. R. Co.....	180, 336. 97	
Other labor furnished.....	27, 449. 55	
Miscellaneous.....		3, 064, 916. 20
Telegraph and telephone service.....	3, 547. 35	
Hotels and boarding camps.....	758, 470. 34	
Hotel coupon books.....	32, 238. 28	
Laundry receipts.....	7, 382. 01	
Corral receipts.....	8, 628. 56	
Miscellaneous.....	93, 740. 47	
Interest on loans.....	473, 194. 27	
Repayment of loans.....	1, 687, 714. 92	
Subsidies and dividends.....		976, 820. 00
Annual subsidy from Panama R. R. Co.....	631, 875. 00	
Dividends on Panama R. R. stock.....	344, 945. 00	
Total.....		5, 856, 426. 77

TABLE 5.—*Detailed statement of classified expenditures for the fiscal year ending June 30, 1912, and total from the beginning of the work to date.*

	Total fiscal year 1912.	Total to June 30, 1912.
Department of civil administration:		
Administration.....	\$73, 864. 59	\$551, 336. 52
Supreme and circuit courts.....	34, 030. 17	331, 946. 01
Prosecuting attorney.....		39, 558. 47
Division of revenues.....	20, 418. 33	166, 115. 13
Division of posts.....	94, 937. 67	652, 958. 42
Division of customs.....	9, 533. 89	66, 730. 67
Division of lands and buildings.....		102, 046. 07
Division of estates.....	2, 560. 40	26, 672. 63
Police and prisons.....	310, 206. 20	1, 989, 197. 90
Fire protection.....	137, 166. 54	691, 492. 76
Maintenance and operation of waterworks and sewers, Panama.....	25, 268. 89	144, 751. 16
Maintenance and operation of waterworks and sewers, Colon.....	44, 202. 54	209, 575. 58
Repairs and maintenance of pavements, Panama.....	10, 294. 97	26, 767. 56
Repairs and maintenance of pavements, Colon.....	10, 268. 31	39, 156. 79
Miscellaneous Zone public works.....	5, 394. 68	28, 620. 12
Treasurer of the Canal Zone.....	9, 470. 61	38, 403. 98
Construction of buildings.....	7, 461. 76	514, 111. 50
Repairs of buildings.....	6, 169. 18	17, 478. 40
Survey of lands, Canal Zone.....	19, 149. 84	75, 000. 00
Total, department of civil administration.....	820, 398. 57	5, 711, 919. 67
Department of law:		
Office of counsel and chief attorney.....	17, 932. 43	17, 932. 43
Land office.....	6, 796. 73	6, 796. 73
Total, department of law.....	24, 729. 16	24, 729. 16

TABLE 5.—Detailed statement of classified expenditures for the fiscal year ending June 30, 1912, and total from the beginning of the work to date—Continued.

	Total fiscal year 1912.	Total to June 30, 1912.
Department of sanitation:		
Administration.....	\$86,378.11	\$776,451.27
Hospitals and asylums—		
Medical storehouse, Colon.....	9,360.33	31,564.14
Ancon hospital.....	426,383.65	3,291,621.41
Colon hospital.....	195,588.90	1,718,234.40
Tobago sanitarium.....	33,829.50	100,356.88
Santo Tomas hospital.....	10,601.51	50,622.16
Other hospitals, dispensaries, and sick camps.....	194,093.01	1,885,178.75
Quarantine.....	35,861.36	324,966.27
Sanitation, Panama and Colon—		
Sanitation proper, Panama.....	38,960.58	769,255.23
Disposal of garbage, street cleaning, etc., Panama.....	10,627.34	70,374.05
Sanitation proper, Colon.....	29,097.61	582,891.00
Disposal of garbage, street cleaning, etc., Colon.....	8,045.16	36,619.93
Zone sanitation—		
Sanitation proper.....	409,205.84	3,644,222.39
Disposal of garbage, street cleaning, etc.....	100,762.20	421,072.01
Construction of buildings.....	8,409.44	1,033,891.46
Repairs to buildings.....	23,236.58	77,472.62
Total, department of sanitation.....	1,620,391.12	14,814,763.97
Department of construction and engineering:		
Atlantic division—		
Dry excavation (prism)—		
Construction work.....	272,958.97	1,466,461.27
Plant.....	¹ 15,847.61	.....
Dredging excavation (prism)—		
Construction work.....	1,309,154.63	6,956,729.41
Plant.....	¹ 276,539.01	386,121.97
Gatun dam and spillway—		
Construction work.....	3,087,012.94	10,607,908.02
Plant.....	¹ 424,773.01	¹ 115,540.84
Gatun locks—		
Construction work.....	6,658,407.89	21,798,996.31
Plant.....	¹ 538,366.82	175,870.62
Gatun power plant, permanent—Construction work.....	37,615.02	37,615.02
Rock and sand account—		
Porto Bello rock plant.....	¹ 280,138.12	188,703.53
Nombre de Dios sand plant.....	¹ 143,132.04	.....
Transportation plant.....	¹ 216,603.90	422,059.46
Colon breakwater—		
Construction work.....	998,585.69	1,663,968.34
Plant.....	¹ 456,061.08	211,370.13
Gatun—Mindi levee.....	.....	72,468.47
Total, Atlantic division.....	10,012,273.55	43,872,646.71
Central division—		
Dry excavation—		
Construction work.....	9,320,755.28	76,313,361.80
Plant.....	¹ 713,474.18	67,936.84
Dredging excavation—construction work.....	.....	9,798.40
Clearing channel in Gatun Lake.....	2,110.34	141,426.75
Masonry—		
Construction work.....	6,208.33	12,432.77
Plant.....	10,358.00	19,116.00
Total, Central division.....	8,625,957.77	76,564,072.56
Pacific division—		
Dry excavation (prism)—		
Construction work.....	688,041.33	1,050,203.26
Plant.....	¹ 70,122.82	247,923.63
Dredging excavation (prism)—		
Construction work.....	1,333,171.17	8,509,228.60
Plant.....	344,132.83	745,278.15
Pedro Miguel locks and dams—		
Construction work.....	2,797,835.24	8,503,476.28
Plant.....	¹ 182,437.70	99,609.46
Miraflores locks and dams—		
Construction work.....	5,551,601.40	11,071,481.66
Plant.....	¹ 364,382.11	428,321.49
Rock and sand account—		
Ancon rock plant.....	¹ 225,465.10	214,647.89
Chame sand plant.....	21,523.03	159,422.15
Miraflores power plant—construction.....	¹ 131,476.07	262,364.40
Naos Island breakwater—construction work.....	134,839.41	192,945.47

¹ Credit.

TABLE 5.—Detailed statement of classified expenditures for the fiscal year ending June 30, 1912, and total from the beginning of the work to date—Continued.

	Total fiscal year 1912.	Total to June 30, 1912.
Department of construction and engineering—Continued.		
Pacific division—Continued.		
Terminal facilities—Balboa—		
Construction work.....	\$172,886.63	\$172,886.63
Plant.....	53,505.88	53,505.88
Total, Pacific division.....	10,123,653.12	31,711,294.95
General—		
Construction work.....	111,619.93	125,994.81
Plant.....	24,233.73	24,233.73
Total, general.....	135,853.66	150,228.54
General items:		
Hotels, messes and kitchens—operations.....	¹ 37,517.65	¹ 70,345.17
Hotel equipment.....	19,047.50	19,047.50
Hotels—incidental expenses.....	19,164.10	19,164.10
Hotel Tivoli.....	¹ 53,652.36	¹ 80,077.41
Hotels, messes and kitchens—alterations and improvements.....	70,226.85	75,510.21
Lands purchased—		
For construction work or to be flooded.....	¹ 16,108.97	330,243.73
For other purposes.....	49,828.00	127,038.35
Cristobal terminals—		
Docks and wharves.....	¹ 27,063.93	262,482.33
Dredging.....	5,582.68	84,773.74
Balboa terminals—docks and wharves.....	¹ 33,843.31	172,868.13
Panama R. R. second main track.....		1,123,477.93
Relocation of Panama R. R.—		
Construction work.....	1,943,086.69	8,529,733.91
Maintenance.....	15,340.61	44,412.06
Plant.....	¹ 110,204.17	309,327.27
Purchase, improvement, and repair of steamers—		
Panama.....		655,942.48
Colon.....		579,812.22
Cristobal.....	2,750.00	716,085.43
Ancon.....	2,750.00	728,271.88
Construction of buildings, department of construction and engineering.....	10,993.18	9,591,999.34
Alteration and repair of buildings, department of construction and engineering.....	117,447.67	541,129.70
Purchase from New Panama Canal Co.....		40,000,000.00
Payment to Republic of Panama.....		10,000,000.00
Loans to Panama R. R. Co.....		3,247,332.11
Purchase of Panama R. R. stock.....		157,118.24
Construction of waterworks and sewers, Panama.....	26,329.05	681,217.78
Construction of waterworks and sewers, Colon.....	30,968.15	614,233.64
Zone waterworks and sewers—		
Construction work.....	214,260.46	4,073,167.89
Maintenance.....	338,028.50	953,840.12
Paving Panama.....	12,416.00	579,374.18
Paving Colon.....	53,560.26	434,600.03
Zone roadways—		
Construction work.....	2,247.47	1,411,504.57
Repairs and maintenance.....	31,878.39	142,766.80
Miscellaneous grading and other municipal work.....	14.35	4,142.62
Moving and care of French material and equipment.....		2,833.23
Plant in Panama R. R. service.....	113,500.26	707,062.48
Permanent plant.....	8,896.75	33,489.76
Total, general items.....	2,819,926.53	86,803,581.18
Fortifications—Armament of fortifications.....	557,746.71	557,746.71
Atlantic seacoast batteries:		
Construction work.....	242,054.28	242,054.28
Plant.....	52,838.29	52,838.29
Pacific seacoast batteries:		
Construction work.....	304,747.42	304,747.42
Plant.....	55,494.96	55,494.96
Total, fortifications.....	1,212,881.66	1,212,881.66
Grand total.....	35,396,065.14	260,866,118.40

¹ Credit.

Expenditure accounts which are prorated monthly to the construction divisions and departments of sanitation and civil administration as overhead charges for the fiscal year ending June 30, 1912.

General administrative expenses.....	\$259,194.95
Miscellaneous general expenses:	
On the Isthmus.....	91,851.49
Canal Record.....	18,270.04
Young Men's Christian Association clubhouses—operation.....	50,565.61
Isthmian Canal Commission band.....	12,479.14
In the United States.....	96,767.10
Disbursing officers:	
In Washington.....	34,048.69
On the Isthmus.....	72,968.32
Examiner of accounts:	
In Washington.....	12,021.02
On the Isthmus.....	159,470.05
Transportation on the Isthmus:	
Passenger.....	109,287.90
Freight.....	482,500.00
Telegraph and telephones.....	143,634.64
Purchasing expenses in the United States.....	160,821.91
Inspection of lock gates, emergency dams, etc.....	115,909.20
Lock gates.....	10,726.24
Operating machinery for locks.....	17,040.20
Emergency dams.....	10,376.78
Spillway gates and machinery.....	1,254.65
Compensation to injured employees.....	204,156.89
Operation of stores.....	462,031.90
Recruiting.....	65,915.45
Quarters.....	415,636.75
Construction of buildings, department of construction and engineering.....	1,775.96
Alteration and repair of buildings, department of construction and engineering.....	7,552.41
Operation of docks and wharves:	
By the Panama Railroad.....	23,969.98
By the Isthmian Canal Commission.....	19,862.68
Total.....	3,060,089.95

TABLE 6.—Statement of general administrative expenses and of general expenses for the fiscal year ended June 30, 1912, which have been prorated to the various divisions and departments for distribution to classified expenditure accounts shown in table No. 5.

	Total.	Atlantic division.	Central division.	Pacific division.	First division, chairman's office.		Civil administration.	Sanitation.	Relocation.	Fortification.
					Lights and buoys.	Machine installation.				
General administrative expenses ¹	\$259, 194. 95	\$103, 392. 00	\$45, 349. 93	\$101, 856. 09	\$632. 07	\$5, 218. 83	.....	.....	.....	\$2, 746. 03
Miscellaneous general expenses:										
On the Isthmus ²	91, 851. 49	25, 055. 23	29, 730. 73	20, 486. 39	353. 86	730. 34	\$3, 746. 74	\$6, 788. 36	\$3, 520. 76	1, 439. 08
Canal Record ³	18, 270. 04	4, 541. 51	5, 844. 59	3, 883. 21	53. 33	163. 36	1, 379. 91	1, 525. 71	713. 20	165. 22
Young Men's Christian Association clubhouses—Operation ³	50, 565. 61	12, 481. 36	16, 139. 27	10, 843. 21	144. 17	502. 23	3, 826. 44	4, 232. 11	1, 895. 18	501. 64
Isthmian Canal Commission band ²	12, 479. 14	3, 395. 58	4, 041. 84	2, 792. 43	47. 33	101. 02	510. 16	921. 32	470. 86	198. 60
In the United States ²	96, 767. 10	26, 981. 04	32, 547. 07	22, 714. 39	363. 68	950. 44	4, 058. 33	7, 240. 91	.....	1, 911. 24
Disbursing officers:										
In Washington ²	34, 048. 69	9, 625. 37	11, 450. 04	7, 926. 75	134. 46	286. 97	1, 444. 44	2, 617. 18	.....	563. 48
On Isthmus ²	72, 968. 32	20, 550. 41	24, 461. 68	17, 103. 99	287. 66	636. 88	3, 080. 39	5, 605. 39	.....	1, 232. 92
Examiner of accounts:										
In Washington ²	12, 021. 02	3, 391. 28	4, 041. 18	2, 805. 47	47. 63	103. 27	508. 91	920. 60	.....	202. 68
On Isthmus ²	159, 470. 05	45, 161. 81	53, 768. 97	36, 947. 47	620. 15	1, 308. 83	6, 798. 49	12, 253. 67	.....	2, 610. 66
Transportation on Isthmus (passenger) ⁴	109, 287. 90	23, 778. 65	30, 665. 77	20, 495. 93	282. 50	906. 39	11, 882. 74	17, 203. 73	3, 168. 40	903. 79
Telegraph and telephones ⁵	143, 634. 64	32, 612. 93	70, 283. 36	8, 966. 06	.....	.....	15, 245. 08	16, 527. 21	.....	.....
Purchasing expenses in United States ⁶	160, 821. 91	48, 254. 56	28, 625. 55	58, 501. 34	756. 10	11, 066. 60	1, 146. 11	2, 558. 21	7, 123. 54	2, 789. 90
Inspection of lock gates, emergency dams, etc. ⁷	115, 909. 20	57, 954. 59	.....	57, 954. 61	.....	.....	.....	.....	.....	.....
Inspection of lock gates ⁷	10, 726. 24	5, 363. 12	.....	5, 363. 12	.....	.....	.....	.....	.....	.....
Inspection of operating machinery ¹³	17, 040. 20	2, 415. 60	.....	2, 415. 60	.....	12, 209. 00	.....	.....	.....	.....
Inspection of emergency dams ⁷	10, 376. 78	5, 188. 39	.....	5, 188. 39	.....	.....	.....	.....	.....	.....
Inspection of spillway gates and machinery ⁷	1, 254. 65	627. 33	.....	627. 32	.....	.....	.....	.....	.....	.....
Operation of stores ⁸	462, 031. 90	192, 945. 89	73, 612. 54	143, 227. 69	2, 596. 31	10, 265. 65	4, 004. 99	6, 899. 07	18, 133. 17	10, 346. 59
Recruiting ²	65, 915. 45	18, 658. 72	22, 199. 98	15, 348. 44	275. 96	531. 20	2, 762. 49	5, 089. 02	.....	1, 049. 64
Quarters ²	415, 636. 75	117, 376. 38	140, 030. 80	96, 632. 55	1, 603. 05	3, 493. 79	17, 638. 31	31, 946. 52	.....	6, 915. 35
Construction of buildings, department of construction and engineering ⁹	1, 775. 96	530. 88	424. 63	578. 37	7. 09	78. 03	41. 42	81. 98	.....	33. 56
Alteration and repair of buildings, department of construction and engineering ⁹	7, 552. 41	2, 303. 90	2, 009. 10	2, 280. 67	29. 37	241. 62	197. 28	372. 62	.....	126. 85
Operations of docks and wharves:										
By Panama R. R. Co. ¹⁰	23, 969. 98	5, 583. 31	4, 144. 86	9, 226. 46	101. 10	2, 582. 30	157. 50	368. 37	1, 220. 92	585. 16
By Isthmian Canal Commission ¹⁰	19, 862. 68	5, 015. 02	3, 762. 78	7, 541. 09	111. 26	1, 652. 15	134. 22	318. 63	914. 55	412. 98
Total.....	2, 373, 433. 06	773, 184. 86	603, 125. 67	661, 707. 04	8, 447. 08	53, 028. 90	78, 572. 95	123, 470. 61	37, 160. 58	34, 735. 37

DIRECT DIVISION COSTS.										
Transportation on Isthmus (freight) ¹¹										
Compensation to injured employees ¹²										
Total.....										
Grand total.....										

¹ Prorated on basis of total expenses of construction divisions, excepting amounts which can be definitely located to the work.
² Prorated on basis of total salaries and wages charges to expenditures and to rock and sand manufacturing accounts, excepting proportion of miscellaneous general expenses: On Isthmus and Isthmian Canal Commission band.
³ Prorated on basis of pay rolls for gold employees, excepting proportion of miscellaneous general expenses: Canal Record and Operation of Young Men's Christian Association clubhouses.
⁴ Prorated on basis of pay rolls for gold employees, excepting proportion located to departments and divisions on basis of actual transportation furnished.
⁵ Prorated on basis of benefits received.
⁶ Prorated on basis of total value of material and supplies issued by Quartermaster's Department, less coal.
⁷ Prorated equally to Atlantic and Pacific divisions.
⁸ Prorated on basis of total value of foreman's orders drawn.
⁹ Prorated on basis of total expenditures.
¹⁰ Prorated on basis of total value of material and supplies is sued by Quartermaster's Department, less coal, and cement delivered to barges for Atlantic Division.
¹¹ Prorated on basis of actual freight handled.
¹² Prorated on actual basis.
¹³ Prorated by first division of chairman's office.

TABLE 7.—Statement of plant and equipment purchased for and absorbed in construction work to June 30, 1912.

	Debits.				Credit by arbitraries charged to work.				Balance to be absorbed after June 30, 1912.	
	Plant charge to June 30, 1909.	Fiscal year—			Total plant charges.	Arbitraries applied to June 30, 1909.	Fiscal year—			Total arbitraries applied.
		1910	1911	1912			1910	1911			1912
ATLANTIC DIVISION PLANT.										
Dry excavation.....	\$196,507.74	\$9,763.99	\$285.45	\$61,233.31	\$121,431.87	\$34,225.06	\$35,052.64	\$77,080.92	\$267,790.49	
Dredging excavation.....	1,711,184.35	306,187.66	128,398.12	111,982.26	809,750.75	311,231.45	362,126.95	264,556.75	1,747,665.90	
Gatun dam and spillway.....	826,794.83	117,141.54	576,839.19	35,159.88	325,185.71	376,743.91	509,613.77	459,932.89	1,671,476.28	
Gatun locks.....	1,057,054.39	947,060.82	405,445.17	65,566.98	360,229.79	442,244.09	892,849.06	700,489.60	2,395,812.54	
Porto Bello rock.....	996,834.43	56,480.22	89,133.60	62,540.27	14,562.13	220,446.97	438,592.50	342,678.39	1,016,279.99	
Nombre de Dios sand.....	235,973.20	160,088.80	26,172.56	21,348.83	4,588.68	65,052.80	209,461.04	164,480.87	443,583.39	
Transportation.....	1,150,882.08	363,509.48	149,477.84	218,275.11	1,882,144.51	327,681.29	676,699.82	434,879.01	1,460,085.05	
Colon breakwater.....	326,969.71	122,210.00	272,787.89	1,316,940.77	405,026.83	.....	54,536.39	139,120.31	193,656.70	
Total.....	6,502,200.73	2,082,442.51	1,648,539.82	135,201.35	10,368,384.41	1,777,625.57	3,178,932.17	2,583,218.74	9,196,350.34	
CENTRAL DIVISION PLANT.										
Dry excavation.....	10,589,005.30	1 101,412.26	1 207,892.24	1 39,797.30	5,327,837.58	2,318,183.00	1,852,269.20	673,676.88	10,171,966.66	
Masonry.....	.....	.....	8,758.00	10,358.00	.....	.....	.....	.....	.....	
Total.....	10,589,005.30	1 101,412.26	1 199,134.24	1 29,439.30	5,327,837.58	2,318,183.00	1,852,269.20	673,676.88	10,171,966.66	
PACIFIC DIVISION PLANT.										
Dry excavation.....	282,510.01	19,999.47	58,824.13	81,451.95	13,430.96	9,970.30	19,885.90	151,574.77	194,861.93	
Dredging excavation.....	2,244,385.70	597,832.22	145,224.79	434,195.80	1,507,285.13	639,047.48	439,964.78	90,062.97	2,676,360.36	
Pedro Miguel locks and dams.....	323,551.00	479,830.19	32,291.70	77,612.02	71,972.15	112,175.64	369,477.94	274,451.33	828,077.06	
Miraflores locks and dams.....	465,869.06	460,729.49	318,808.63	163,931.81	181,612.13	58,914.77	212,176.68	556,805.99	1,009,509.57	
Ancon rock.....	327,914.15	441,043.87	47,368.51	28,615.58	.....	59,559.16	316,654.38	254,080.68	630,294.22	
Chamé sand.....	162,105.52	133,352.07	19,910.77	126,729.84	.....	40,661.02	136,808.22	105,206.81	282,676.05	
Miraflores power plant.....	218,934.91	274,693.99	3,902.33	1,516.72	.....	7,532.08	96,158.68	132,992.79	236,683.55	
Terminal facilities—Balboa.....	.....	.....	.....	53,505.88	.....	.....	.....	.....	.....	
Total.....	4,025,270.35	2,407,481.30	626,330.86	967,559.60	1,774,300.37	927,860.45	1,591,126.58	1,565,175.34	5,858,462.74	

CHAIRMAN'S OFFICE PLANT.										
Operating machinery in- stallation:										
Gatun.....						96,555.80				96,555.80
Pedro Miguel.....						14,401.61				14,401.61
Miraflores.....						28,492.07				28,492.07
Lighting and buoying the canal.....						24,233.73				24,233.73
Total.....						163,683.21				163,683.21
Grand total.....	21,116,476.38	4,388,511.55	2,075,736.44	1,237,004.86	28,817,729.23	8,758,711.81	5,023,669.02	6,622,327.95	4,822,070.96	25,226,779.74
SEACOAST BATTERIES PLANT. ³										
Atlantic.....						52,838.29				
Pacific.....						55,494.96				
MISCELLANEOUS PLANT NOT CREDITED BY AR- BITRARIES.										
Relocation of Panama R. R.....						309,327.27				
Plant loaned to Panama R. R.....						707,062.48				
Purchase, improvement, and repair of steamers:										
Panama (less rentals).....						655,942.48				
Colon (less rentals).....						579,812.22				
Cristobal.....						716,058.43				
Aneon.....						728,271.88				
Permanent shops.....						33,489.76				
Total.....					32,656,027.00					

¹ Credit by transfers.² Arbitraries applied in excess of plant charges to be adjusted.³ Arbitraries will be applied on seacoast batteries plant.

NOTE.—This statement does not include docks and wharves, construction of buildings, waterworks and sewers, pavements, and roads.

TABLE 8.—Statement of receipts and disbursements from appropriations for fiscal year ending June 30, 1912.

	Balance brought forward July 1, 1911.	Balance of appropriation, Mar. 4, 1911, immediately available, taken into account July 1, 1911.	Collections repaid appropriations during fiscal year.	Transfers between Isthmian Canal Commission appropriations on charges rendered between departments.	Total available during the year.	Disbursements.	Available balances June 30, 1912.
In the United States:							
Salaries.....	\$26,379.41	\$130,000.00	\$3,264.00	.....	\$159,643.41	\$146,947.89	\$12,695.52
Incidentals.....	29,196.99	50,000.00	1,608.57	.....	80,805.56	62,202.24	18,603.32
Construction and engineering:							
Officers and employees.....	697,517.37	3,900,000.00	81,081.03	\$98,892.58	4,777,490.98	3,659,441.52	1,118,049.46
Skilled and unskilled labor.....	2,658,834.43	16,500,000.00	161,305.57	529,252.38	16,849,392.38	14,159,588.63	5,689,803.75
Material and supplies.....	5,913,726.35	19,000,000.00	4,123,729.61	917,508.92	29,954,964.88	15,332,147.94	14,622,816.94
Incidental expenses.....	884,619.51	.....	29,795.12	4,124.90	918,539.53	831,179.89	87,359.64
Civil administration:							
Officers and employees.....	171,523.03	550,000.00	20,427.66	4,298.33	746,249.02	653,742.86	92,506.16
Skilled and unskilled labor.....	30,797.61	.....	.....	109.44	30,907.05	23,409.67	7,497.38
Material and expenses.....	72,364.69	110,000.00	349.22	187,728.95	94,884.96	34,615.30	60,369.66
Sanitation:							
Officers and employees.....	669,654.93	.....	39,170.19	471.52	709,296.64	693,578.83	15,717.81
Skilled and unskilled labor.....	219,781.93	.....	10,792.09	1,189.98	231,764.00	196,246.23	35,517.77
Material and expenses.....	133,678.18	800,000.00	64,285.35	1,410,880.89	637,082.64	370,595.94	266,486.70
Relocation of Panama R. R.....	2,048,170.47	.....	.....	.....	2,048,170.47	.....	2,048,170.47
Canal connecting Atlantic and Pacific Oceans.....	2,941,921.95	.....	19,666.16	1,650,013.68	2,311,574.43	1,421,189.69	890,384.74
Sanitation in cities of Panama and Colon.....	1,502,377.41	.....	.....	1,134,432.94	1,502,377.41	13,748.00	1,488,629.41
Survey of lands, Canal Zone.....	334,965.56	.....	.....	1,42,318.83	200,532.62	.....	200,532.62
Armanent of fortifications.....	42,797.24	.....	.....	.....	478.41	.....	478.41
Seacoast batteries.....	969,391.25	2,000,000.00	.....	1,230,472.76	969,391.25	470,445.52	498,945.73
Total.....	19,397,698.31	43,040,000.00	4,555,474.57	.....	66,993,172.88	38,304,157.01	28,689,015.87

¹ Charges against appropriation. Items not marked (1) are credits to appropriations and offset total charges in this column.

TABLE 9.—*Detailed statement of amounts returnable to the appropriations collected during the fiscal year ending June 30, 1912.*

Nature of collections.	From employees (act of Mar. 4, 1907).	From out- side parties (act of Mar. 4, 1911). ¹	From other de- partments of the gov- ernment.	From over- payments and mis- cellaneous items.	Total.
Sale of property.....	\$31,158.96	\$1,629,344.75	\$44,766.95	\$1,094.92	\$1,706,365.58
Panama water rents.....		97,596.78			97,596.78
Colon water rents.....		85,193.65			85,193.65
Zone water rents.....			3,226.66		3,226.66
Rentals, miscellaneous.....		52,692.85	4,622.26		57,315.11
Labor furnished Panama R. R. Co.....		573,486.84		176.71	573,663.55
Other labor furnished.....	1,542.02	145,052.41	53,161.17	499.65	200,255.25
Sale of hotel books.....		193,725.39			193,725.39
Hotel and boarding-camp receipts.....	1,181,127.41	87,999.73	252.33		1,269,379.47
Hospital receipts.....	105,520.96	60,912.77	747.96		167,181.69
Laundry receipts.....	6,916.50	6,196.03	11.97		13,124.50
Quarantine receipts.....	906.17	19,277.33			20,183.50
Corral receipts.....	17,351.95	54,887.49	4,566.19		76,805.63
Telegraph and telephone receipts.....	419.09	63.35		246.15	728.59
Transportation.....	4,577.67	1,845.26	80.00	80.00	6,582.93
Electric-light receipts.....	114.67	29,190.62	5,072.70		34,377.99
Sales of scrap.....		45,228.08			45,228.08
Duties on scrap.....		3,485.57			3,485.57
Miscellaneous.....		1,583.44			1,583.44
Overpayments and corrections.....				21,478.65	21,478.65
Marine insurance.....				81,863.63	81,863.63
Total.....	² 1,349,635.40	3,087,762.34	116,508.19	105,439.71	4,659,345.64

¹ Detailed statement of collections as required by sec. 4, act of Mar. 4, 1911.² This amount is made up of both cash collections and pay-roll deductions from employees.TABLE 10.—*Detailed statement of collections repaid to appropriations during the fiscal year ending June 30, 1912, and balance of fiscal year collections returnable to appropriations but not repaid during the year.*

Nature of collections.	From employees (act of Mar. 4, 1907).	From out- side parties (act of Mar. 4, 1911).	From other de- partments of the gov- ernment.	From over- pay- ments and mis- cellaneous items.	Total repayments.	Balance of collections fiscal year 1912 re- turnable but not repaid.
Sale of property.....	\$31,158.96	\$1,551,578.82	\$44,766.95	\$1,094.92	\$1,628,599.65	\$101,151.10
Panama water rents.....		97,719.77			97,719.77	244.30
Colon water rents.....		86,301.15			86,301.15	
Zone water rents.....			3,226.66		3,226.66	
Rentals, miscellaneous.....		52,720.45	4,622.26		57,342.71	3,902.50
Labor furnished Panama R. R. Co.....		553,883.01		176.71	554,059.72	37,380.42
Other labor furnished.....	1,542.02	142,581.95	53,161.17	499.65	197,784.79	11,175.25
Sale of hotel books.....		189,786.09			189,786.09	16,364.70
Hotel and boarding-camp receipts.....	1,181,127.41	83,401.77	252.33		1,264,781.51	9,834.24
Hospital receipts.....	105,520.96	69,060.37	747.96		175,329.29	2,035.05
Laundry receipts.....	6,916.50	6,045.27	11.97		12,973.74	646.84
Quarantine receipts.....	906.17	18,337.01			19,243.18	2,017.67
Corral receipts.....	17,351.95	49,695.82	4,566.19		71,613.96	7,770.74
Telegraph and telephone receipts.....	419.09	68.95		246.15	734.19	3.85
Transportation.....	4,577.67	1,396.50	80.00	80.00	6,134.17	448.76
Electric-light receipts.....	114.67	31,030.05	5,072.70		36,217.42	952.84
Sales of scrap.....		45,228.08			45,228.08	
Duties on scrap.....		3,485.57			3,485.57	
Miscellaneous.....		1,570.64			1,570.64	12.80
Overpayments and correc- tions.....				21,478.65	21,478.65	
Marine insurance.....				81,863.63	81,863.63	
Total.....	1,349,635.40	2,983,891.27	116,508.19	105,439.71	4,555,474.57	¹ 193,941.06

¹ See Table 2.

TABLE 11.—Statement of collections made on pay rolls of the Isthmian Canal Commission during the fiscal year ending June 30, 1912, as authorized by section 8 of the act of Mar. 4, 1907.

Month.	Total.	Commissary coupon books.	Hotel coupon books.	Subsistence.	Lost metal checks.	Transportation.	Medical service.	Bills collectible.	Miscellaneous.
GOLD ROLLS.									
1911—July.....	\$134,959.41	\$92,365.00	\$37,427.77	.....	\$31.00	.....	\$2,271.67	\$14.06	\$2,849.91
August.....	138,876.04	94,740.00	36,871.80	.....	26.50	\$20.00	2,208.05	895.67	4,114.02
September.....	142,744.63	98,470.00	36,289.83	.....	23.50	.....	2,634.76	390.02	4,919.92
October.....	142,844.97	97,970.00	37,552.53	.....	23.50	27.00	3,036.12	252.57	3,985.25
November.....	143,481.06	98,412.50	37,899.50	.....	21.50	67.00	2,815.59	315.70	3,949.27
December.....	145,693.69	101,502.31	37,144.92	\$0.04	20.00	73.00	2,658.88	237.24	4,055.30
1912—January.....	150,880.08	115,575.00	37,455.53	.....	22.00	.....	2,766.60	258.02	3,802.93
February.....	147,155.21	100,981.67	39,494.37	.....	18.00	60.00	2,293.21	356.86	3,951.10
March.....	147,603.14	101,165.00	39,111.55	5.20	18.50	.....	3,176.59	701.54	3,424.76
April.....	143,960.18	99,445.17	38,719.80	.40	17.50	.....	2,870.70	517.08	2,388.93
May.....	143,099.05	100,554.17	36,984.60	6.90	14.50	150.00	2,809.72	370.34	2,208.82
June.....	140,386.70	97,762.67	36,703.00	1.80	18.50	.....	2,529.16	753.02	2,618.55
Total.....	1,730,684.16	1,198,943.49	451,646.20	14.34	263.00	392.00	32,691.05	5,063.32	42,268.76
SILVER ROLLS.									
1911—July.....	164,443.07	129,660.62	90.00	22,550.29	261.50	319.15	609.76	.....	951.75
August.....	166,614.77	129,859.00	45.00	35,253.86	297.50	19.00	771.39	24.40	344.02
September.....	190,350.55	148,834.53	75.00	40,130.82	277.00	17.60	598.03	6.25	411.32
October.....	201,268.15	154,438.41	69.60	45,282.28	316.33	182.28	577.33	13.11	388.81
November.....	200,851.00	154,597.34	129.60	41,638.55	262.50	162.60	655.75	37.25	427.47
December.....	196,752.83	151,191.52	90.00	44,331.45	260.00	93.28	433.59	.....	352.99
1912—January.....	221,540.05	172,799.63	99.60	47,252.41	321.00	41.32	659.51	.....	366.58
February.....	194,597.43	148,859.07	84.60	44,014.43	305.50	47.60	734.96	.....	551.27
March.....	193,936.60	151,002.27	40.80	41,473.49	268.00	47.70	585.28	20.00	490.06
April.....	205,297.48	159,877.71	60.60	43,737.00	296.00	38.10	756.89	3.12	519.06
May.....	203,862.68	161,390.56	119.40	41,644.83	289.50	5.00	555.06	1.50	456.83
June.....	204,254.80	162,078.95	120.00	40,712.54	291.50	.....	598.29	20.13	433.39
Total.....	2,343,769.47	1,824,590.21	1,042.20	500,421.95	3,446.33	913.63	7,555.84	125.76	5,693.55
Grand total of collections.....	4,074,453.63	3,023,533.70	452,688.40	500,436.29	3,711.33	1,305.63	39,626.89	5,189.08	47,962.31
Collected for Panama R. R. Co. and various individuals.....	3,046,799.95	3,023,533.70	.....	.....	.....	.....	.....	.....	23,266.25
Returnable to appropriations (Table 9).....	1,027,653.68	.....	452,688.40	500,436.29	3,711.33	1,305.63	39,626.89	5,189.08	24,696.06

TABLE 12.—Statement of audited pay rolls on Isthmus during fiscal year 1912.

	Total pay rolls.	Officers and em- ployees.		Skilled and unskilled labor.		Seacoast batteries.		Miscellaneous mate- rial purchases. ¹		Collected for indi- viduals and com- panies. ²	
		Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.	Amount.	Per cent of total.
Chairman and chief engineer.....	\$819, 209.44	\$394, 838.77	48.20	\$157, 054.65	19.17	\$245, 680.69	29.99	\$21, 635.33	2.64	\$837.39	0.02
Atlantic division.....	4, 339, 272.53	897, 721.05	20.69	3, 440, 714.09	79.29						
Central division.....	4, 931, 175.82	730, 359.28	14.81	4, 200, 816.54	85.19						
Pacific division.....	3, 825, 163.73	604, 607.38	15.81	3, 193, 022.26	83.47						
Mechanical division.....	2, 117, 008.43	243, 816.02	11.52	1, 873, 192.41	88.48	27, 534.09	.72				
Quartermaster's department.....	1, 308, 665.61	423, 902.04	32.39	884, 763.57	67.61						
Subsistence department.....	204, 474.14	78, 192.35	38.24	126, 281.79	61.76						
Examiner of accounts.....	170, 921.76	170, 921.76	100.00								
Disbursing officer.....	65, 414.67	65, 414.67	100.00								
Personal-injury claims.....	188, 922.59	21, 260.70	11.25	166, 506.28	88.14	1, 155.61	.61				
Total construction and engineering.	17, 970, 228.72	3, 631, 034.02	20.21	14, 042, 351.59	78.14	274, 370.39	1.53	21, 635.33	.12	837.39	
Sanitary department.....	895, 543.59	693, 671.24	77.46	201, 872.35	22.54						
Personal-injury claims.....	379.67	237.08	62.44	142.59	37.56						
Total sanitary department.....	895, 923.26	693, 908.32	77.45	202, 014.94	22.55						
Department of civil administration.....	641, 312.89	616, 837.39	96.18	24, 475.50	3.82						
Personal-injury claims.....	1, 940.54	1, 890.62	97.43	49.92	2.57						
Total department of civil adminis- tration.....	643, 253.43	618, 728.01	96.19	24, 525.42	3.81						
Total all departments.....	19, 509, 405.41	4, 943, 670.35	25.34	14, 208, 891.95	73.14	274, 370.39	1.41	21, 635.33	.11	837.39	

¹ Lock-gate inspection.

² Gatun labor-train crew paid from fares collected.

TABLE 13.—Statement of bills collectible registered during the fiscal year ending June 30, 1912.

	Number of bills registered.	Total.	Against the Panama R. R.	Against the Canal Zone government.	Against the Republic of Panama.	Against other departments of United States Government.	Against other individuals and companies.	Memorandum bills registered after collections are made.	
								For pay-roll deductions.	For cash remitted by hotels, hospitals, etc.
1911—July.....	453	\$618,177.06	\$197,499.30	\$19,042.27	\$11,428.86	\$1,377.29	\$32,432.31	\$290,388.42	\$57,008.61
August.....	463	509,739.54	145,253.47	5,311.49	1,314.03	1,370.70	26,013.59	304,570.74	25,905.52
September.....	491	570,078.03	168,244.04	9,976.34	12,679.82	2,317.47	19,089.60	332,698.31	25,072.45
October.....	351	507,173.28	58,594.71	5,217.20	1,696.44	23,441.06	13,440.34	343,847.44	60,936.09
November.....	402	535,150.64	115,101.39	14,710.25	5,847.58	1,763.18	25,767.37	343,979.17	27,981.70
December.....	685	642,811.06	184,065.66	14,406.07	15,931.23	5,655.54	49,535.94	342,209.28	31,007.34
1912—January.....	563	859,513.56	266,612.30	12,506.61	6,148.40	5,506.19	113,456.93	381,162.11	74,121.02
February.....	448	666,711.68	190,850.64	5,625.58	5,228.80	36,205.45	34,065.74	341,395.78	53,339.69
March.....	452	515,751.04	69,877.53	8,972.80	2,022.13	6,059.09	35,164.08	340,818.20	52,837.21
April.....	550	722,633.91	213,249.64	9,474.29	5,251.41	7,227.30	51,667.94	348,736.86	87,026.47
May.....	544	624,244.71	175,970.71	6,466.18	6,249.74	6,250.11	53,526.90	346,589.89	29,191.18
June.....	401	714,963.29	269,557.46	31,555.07	6,668.37	4,757.01	38,439.76	343,808.35	20,117.27
Total.....	5,802	7,480,947.80	2,054,876.85	143,264.15	80,466.81	101,930.39	492,600.50	4,069,264.55	544,544.55

TABLE 14.—Statement of meal tickets and hotel coupons honored during fiscal year ending June 30, 1912.

	Kitchens.				Messes.				Hotels.					
	9-cent tickets.		40-cent tickets.		27-cent tickets.		13½-cent tickets.		27-cent tickets.		40-cent tickets.		30-cent coupons.	Value.
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.				
1911—July.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
August.....	1,470	\$132.30	1	\$0.40	33,908	\$9,155.16	241	\$32.13	484	\$130.68	75,593	\$30,237.20	172,179	\$51,653.70
September.....	1,308	117.72	17	6.80	45,073	12,169.71	434	57.87	731	197.37	80,524	32,209.60	171,538	51,461.40
October.....	522	46.98	17	6.80	52,188	14,090.76	545	72.67	118	31.86	88,323	35,329.20	166,718	50,015.40
November.....	510	45.90	1	.40	51,038	13,780.26	1,104	147.20	81	21.87	97,869	39,147.60	174,675	52,402.50
December.....	590	53.10	2	.80	44,893	12,121.11	497	66.27	76	20.52	96,538	38,615.20	169,372	50,811.60
1912—January.....	1,347	121.23	810	324.00	43,960	11,869.20	478	63.73	79	21.33	102,721	41,088.40	175,068	52,520.40
February.....	550	49.50	1,040	416.00	43,943	11,864.61	286	38.13	97	26.19	103,513	41,405.20	182,462	54,738.60
March.....	930	83.70	583	233.20	39,877	10,766.79	457	60.93	88	23.76	91,359	36,543.60	179,889	53,966.70
April.....	1,240	111.60	3	1.20	43,545	11,757.15	303	40.40	112	30.24	94,957	37,982.80	189,203	56,760.90
May.....	1,183	106.47	3	1.20	43,246	11,676.42	284	37.87	92	24.84	89,954	35,981.60	179,328	53,798.40
June.....	1,407	126.63	.....	.....	41,951	11,326.77	667	88.93	85	22.95	89,037	35,614.80	177,850	53,355.00
			.....	.....	39,419	10,643.13	1,553	207.07	36	9.72	83,809	33,547.60	164,878	49,463.40
Total.....	11,057	995.13	2,477	990.80	523,041	141,221.07	6,849	913.20	2,079	561.33	1,094,257	437,702.80	2,103,160	630,948.00

TABLE 15.—Statement of coupon books and meal tickets distributed to issuing clerks during fiscal year ending June, 1912.

COMMISSARY BOOKS.

	\$2.50 books.		\$5 books.		\$15 books.	
	Number.	Value.	Number.	Value.	Number.	Value.
1911—July.....	6,190	\$15,475.00	22,585	\$112,925.00	6,520	\$97,800.00
August.....	8,940	22,350.00	27,745	138,725.00	6,225	93,375.00
September.....	9,045	22,612.50	28,095	140,475.00	5,940	89,100.00
October.....	9,676	24,190.00	28,760	143,800.00	6,371	95,565.00
November.....	10,750	26,875.00	29,910	149,550.00	6,875	103,125.00
December.....	10,129	25,322.50	29,055	145,275.00	7,260	108,900.00
1912—January.....	10,420	26,050.00	29,650	148,250.00	6,874	103,110.00
February.....	9,265	23,162.50	27,895	139,475.00	6,775	101,625.00
March.....	10,550	26,375.00	28,395	141,975.00	7,025	105,375.00
April.....	10,595	26,487.50	31,575	157,875.00	6,650	99,750.00
May.....	12,340	30,850.00	31,090	155,450.00	10,090	151,350.00
June.....	9,295	23,237.50	30,325	151,625.00	5,920	88,800.00
Total.....	117,195	292,987.50	345,080	1,725,400.00	82,525	1,237,875.00

HOTEL BOOKS.

	\$4.80 books.		\$15 books.	
	Number.	Value.	Number.	Value.
1911—July.....	495	\$2,376.00	3,320	\$49,800.00
August.....	260	1,248.00	2,265	33,975.00
September.....	900	4,320.00	3,665	54,975.00
October.....	415	1,992.00	4,495	67,425.00
November.....	885	4,248.00	2,300	34,500.00
December.....	270	1,296.00	2,575	38,625.00
1912—January.....	285	1,368.00	4,205	63,075.00
February.....	585	2,808.00	4,320	64,800.00
March.....	883	4,248.00	3,250	48,750.00
April.....	335	1,608.00	4,530	67,950.00
May.....	770	3,696.00	3,090	46,350.00
June.....	480	2,304.00	4,520	67,800.00
Total.....	6,565	31,512.00	42,535	638,025.00

MEAL TICKETS.

	27-cent tickets.		40-cent tickets.		X102 (no value).
	Number.	Value.	Number.	Value.	
1911—July.....	33,500	\$9,045.00	88,300	\$35,320.00	.....
August.....	27,500	7,425.00	71,600	28,640.00	1,500
September.....	101,900	27,513.00	105,600	42,240.00	1,900
October.....	45,000	12,150.00	125,100	50,040.00	2,100
November.....	46,500	12,555.00	79,300	31,720.00	1,000
December.....	35,700	9,639.00	90,000	36,000.00	1,200
1912—January.....	28,800	7,776.00	101,200	40,480.00	1,200
February.....	52,700	14,229.00	132,500	53,400.00	1,800
March.....	26,200	7,074.00	66,800	26,720.00	1,500
April.....	61,300	16,551.00	105,700	42,280.00	600
May.....	40,800	11,016.00	66,100	26,440.00	2,000
June.....	51,400	13,878.00	115,200	46,080.00	7,500
Total.....	551,300	148,851.00	1,148,400	459,360.00	22,300

1 3,000 books were delivered to the Panama R. R. Co.

TABLE 16.—*Statement of injuries sustained by employees of the Isthmian Canal Commission, July 1, 1911, to June 30, 1912, for which compensation was due or claimed under the acts of Congress of May 30, 1908, and Feb. 24, 1909.*

[illegible]

TABLE 17.—Statement of amounts paid, under act of May 30, 1908, to employees as compensation and on account of death of employees, injured in course of employment, July 1, 1911, to June 30, 1912; and amounts paid, under act of Feb. 24, 1909, for injuries lasting 15 days or less.

Department or division.	July.	August.	September.	October.	November.	December.	January.	February.
Atlantic:								
Injuries.....	\$6,382.38	\$5,414.27	\$3,889.75	\$3,973.64	\$3,837.39	\$3,473.53	\$2,808.03	\$3,842.97
Deaths.....	2,901.28	1,648.10	1,378.38	2,720.27	842.53	935.35	1,373.33	1,057.52
Central:								
Injuries.....	6,392.69	5,177.41	5,109.99	3,870.08	4,519.61	4,390.02	3,375.18	3,372.89
Deaths.....	1,257.04	742.79	484.30	317.70	325.00	587.40	696.84	552.80
Pacific:								
Injuries.....	3,180.64	2,659.03	3,106.18	2,106.12	2,798.42	3,575.55	2,600.70	3,688.55
Deaths.....	728.97	180.43	213.24	536.49	571.60	174.51	729.77	640.51
Mechanical:								
Injuries.....	2,953.22	1,952.77	1,703.80	3,049.25	978.58	1,274.54	1,103.66	1,627.39
Deaths.....	213.36	122.48	280.56	158.72	190.40	30.72	32.00	29.44
Quartermaster:								
Injuries.....	420.75	321.78	295.79	310.45	373.38	804.92	185.73	216.22
Deaths.....	23.40	46.80	22.50		204.79	41.39	34.16	34.17
Sanitary:								
Injuries.....	126.94	166.08	13.25	10.50				24.50
Deaths.....								
Civil administration:								
Injuries.....	255.00			176.54	274.17	356.41	56.08	10.00
Deaths.....	85.00	153.34	58.33	40.00	33.34	40.99		
Chief engineer:								
Injuries.....	25.00	68.50	60.00	61.00	40.10	97.27	232.44	326.70
Deaths.....								
Examiner of accounts:								
Injuries.....			116.25	63.75	215.66	139.55	91.67	
Deaths.....								
Subsistence:								
Injuries.....		38.00	21.88	25.46	15.46	5.63	12.20	
Deaths.....								
Disbursing officer:								
Injuries.....								
Deaths.....								
Total.....	24,945.67	18,694.78	16,754.20	17,419.97	15,220.43	15,927.78	13,331.79	15,423.66

Department or division.	March.	April.	May.	June.	Total injury payments.	Total death payments.	Total under act Feb. 24, 1909.	Grand total.
Atlantic:								
Injuries.....	\$3,322.03	\$3,826.81	\$2,476.59	\$3,494.42	\$46,741.81		\$10,743.05	
Deaths.....	1,081.93	789.82	1,844.77	579.09		\$17,152.37		\$74,637.23
Central:								
Injuries.....	3,530.84	4,043.57	2,943.64	3,318.15	50,044.07		16,620.20	
Deaths.....	667.20	553.10	1,672.31	1,021.86		8,878.34		75,542.61
Pacific:								
Injuries.....	3,850.20	3,244.65	4,089.22	2,837.71	37,736.97		11,644.13	
Deaths.....	1,379.40	691.62	962.60	627.34		7,436.48		56,817.58
Mechanical:								
Injuries.....	1,869.24	1,551.04	1,788.67	1,830.77	21,682.93		13,263.33	
Deaths.....	626.96	116.48	292.96	441.20		2,535.28		37,481.54
Quartermaster:								
Injuries.....	262.18	288.80	457.58	369.41	4,309.99		2,820.21	
Deaths.....	59.17	34.16	85.01	335.66		921.21		8,051.41
Sanitary:								
Injuries.....		25.10		13.30	379.67		121.61	501.28
Deaths.....								
Civil administration:								
Injuries.....			46.67	350.50	1,525.37		441.33	
Deaths.....				200.00		611.00		2,577.70
Chief engineer:								
Injuries.....	582.23	323.43	800.27	711.45	3,328.39			3,328.39
Deaths.....								
Examiner of accounts:								
Injuries.....					626.88		117.07	743.95
Deaths.....								
Subsistence:								
Injuries.....		62.54	31.29	31.67	244.13		62.32	306.45
Deaths.....								
Disbursing officer:								
Injuries.....							5.00	5.00
Deaths.....								
Total.....	17,251.38	15,551.12	17,491.58	16,162.53	166,620.21	37,534.68	55,838.25	259,993.14

Total payments, by fiscal year, to date.

	Injuries.	Deaths.	Under act Feb. 24, 1909.	Total.
Aug. 1, 1908 to June 30, 1909.....	\$32,355.71	\$3,682.79	\$8,225.16	\$44,263.66
July 1, 1909 to June 30, 1910.....	96,810.33	21,053.22	16,010.30	133,873.85
July 1, 1910 to June 30, 1911.....	168,416.23	35,248.39	49,957.80	253,622.42
July 1, 1911 to June 30, 1912.....	166,620.21	37,534.68	55,838.25	259,993.14
Total.....	464,202.48	97,519.08	130,031.51	691,753.07

TABLE 18.—Statement of receipts and disbursements, May 1, 1904–June 30, 1912.

RECEIPTS.

Revenues collected.....	\$1,452,804.30
Postal receipts.....	616,841.74
Total collections.....	\$2,069,646.04

DISBURSEMENTS.

Expenditures:	
Public improvements.....	\$604,310.82
Public schools.....	469,699.22
Maintenance administration district.....	155,554.39
Miscellaneous and contingent.....	18,385.84
Postal service.....	543,773.99
Total disbursements.....	1,791,724.26
Available for expenditures.....	277,921.78

TREASURY BALANCE JUNE 30, 1912.

Public improvements and schools.....	\$219,883.60
Miscellaneous and contingent.....	8,749.74
Postal receipts 1912.....	30,468.82
Transfer from trust funds.....	587.50
	259,689.66
Collecting officers' balance.....	18,110.37
Postmasters' balance.....	145.00
	277,945.03
Audited claims unpaid.....	23.25
Balance available.....	277,921.78

SEPARATE STATEMENT COVERING POSTAL SERVICE.

Receipts:	
Stamp sales.....	\$496,395.25
Stamp book sales.....	199.87
Money-order fees.....	120,246.62
	616,841.74
Disbursements:	
Balance of funds prior to Mar. 4, 1907, consolidated with regular Zone revenues.....	42,453.93
Purchase of stamps.....	206,567.02
Miscellaneous expenditures.....	173,693.76
Transfer to Isthmian Canal Commission as reim- bursement in part for salaries paid.....	163,513.21
	586,227.92
Available expenditure.....	30,613.82
Treasury balance.....	30,468.82
Postmasters' balance.....	145.00
	30,613.82

TABLE 19.—*Receipts and expenditures, Canal Zone funds, from May 1, 1904, to June 30, 1912.*

[This statement includes balances in hands of collecting officers, but does not include money orders, Y. M. C. A., nor trust funds.]

On account of—	To June 30, 1905.	July 1, 1905, to June 30, 1906.	July 1, 1906, to June 30, 1907.	July 1, 1907, to June 30, 1908.	July 1, 1908, to June 30, 1909.	July 1, 1909, to June 30, 1910.	July 1, 1910, to June 30, 1911.	July 1, 1911, to June 30, 1912.	Total.
Revenues:									
Animal license.....				\$402.50	\$1,013.40	\$492.60	\$585.70	\$462.00	\$2,959.45
Aerated waters.....			\$3.25		6,960.80	7,203.20	6,208.80	5,859.60	26,232.40
Auctioneers.....					43.00	35.00	27.00		134.00
Bicycle license.....				4,592.00	7,026.25	4,995.35	4,481.26	7,742.28	645.00
Building rental.....						65.00	15.00		164.00
Bowling alleys.....				1,063.00	921.00	1,259.00	1,812.50	1,950.00	8,130.30
Burial permits.....					29.08				29.08
Burning charcoal.....				861.20	42.25	33.25	85.25	174.00	1,320.70
Cabs and coaches.....			124.75		290.20	380.00	2,188.80	4,160.50	7,019.50
Carts.....					6.50				6.50
Cutting firewood.....	\$637.18	3,184.13	3,196.82	6,793.53	8,510.10	7,511.45	7,001.40	8,490.98	45,325.59
Circuit court collections.....								97.00	97.00
Chauffeurs' license.....			6,875.40	30,390.52	25,448.75	30,299.69	22,449.19	28,169.79	143,633.34
District court collections.....					320.00	290.00		160.00	930.00
Dance halls.....				3,814.94	2,209.00	3,158.67	2,544.98	5,083.71	34,506.58
Distilling license.....	4,980.53	7,539.80	5,174.95			680.04	1,558.27		2,238.31
Escheated estates.....					111.75	105.00	108.75	599.70	925.20
Gathering coconuts.....					84.60	114.80	90.80	93.20	383.40
Hucksters.....			810.00	1,570.00	1,681.00	1,739.00	1,965.00	1,715.00	9,645.00
Hunting permits.....	15.00	150.00			28.40				28.40
Hotels.....				129.02	137.70	234.34	512.59	1,087.83	2,101.48
Insurance tax.....						36,867.94	27,763.40	20,784.96	85,416.30
Interest.....						22,282.69	19,120.80	8,569.80	89,809.23
Land rental.....			584.05	18,803.82	20,448.07	1,491.00			1,401.00
Maintenance miscellaneous public works, refund.....						4,456.55	5,039.58	4,199.90	24,856.28
Market rental.....			1,044.13	5,734.24	4,381.88				1,242.73
Miscellaneous.....	63.25		512.55	623.93	43.00				3,117.00
Motor-vehicle license.....				34,913.58	10,409.01	9,722.26	1,058.00	2,059.00	77,887.44
Merchandise and drugs.....				61.27	364.91	658.02	1,697.94	2,099.45	4,881.59
Marshal fees.....					10,032.50	10,084.00	8,885.00	8,167.50	37,169.00
Peddling.....						130.00	95.00	135.00	606.00
Physicians' license.....	10.00	55.00	21.00	80.00	80.00				16,000.00
Pipe-line license.....			5,500.00	6,000.00	4,500.00		519.10	677.90	4,283.72
Public entertainment.....			225.52	1,225.50	820.80	814.90	1,169.60	1,008.40	10,718.50
Poll tax.....			834.00	3,170.00	2,801.80	1,734.80	1,531.40	530.47	2,327.50
Pound fees.....				140.30	589.23	536.10			3,771.50
Police fees.....				540.99	789.04	424.00	332.92	453.83	3,771.50
Police fees.....				1,395.70	1,274.20	1,515.20	1,181.20	1,076.00	6,700.00
Restaurants.....				40,800.00	72,600.00	65,040.00	97,200.00	48,089.88	326,243.80
Retail liquor license.....	2,513.92		257.70						33,836.80
Retail sale of tobacco.....					8,621.60	9,084.00	8,474.00	7,657.20	

Real-estate tax.....	3,932.18	11,991.16	29,791.25	32,710.96	41,133.61	32,078.11	151,637.27
Sale of property.....	.....	72.50	3,572.50	282.10	5,512.40	1,154.47	10,593.97
Sale of impounded animals.....	.....	.....	35.10	13.25	24.40	191.85	264.60
Sale of impounded meats.....	.....	.....	437.82	545.21	315.91	62.56	1,361.50
School tuition, lost or damaged books.....	.....	247.10	577.59	293.08	774.28	876.23	2,798.70
Stamp paper.....	240.11	.....	.....	.....	.....	.....	316.31
Service district prisoners.....	.....	.....	.....	867.85	6.40	31.86	1,055.91
Slaughter tax.....	1,547.46	13,449.00	12,894.00	15,496.00	17,634.50	12,395.00	78,113.51
Steamboat inspection.....	.....	.....	.....	.....	.....	2,837.15	2,837.15
Water tax.....	.....	2,994.37	7,535.80	12,962.45	20,531.70	30,012.89	74,508.16
Total revenues.....	10,070.13	191,860.17	247,547.88	286,608.75	320,891.63	259,759.68	1,369,143.94
Municipal funds—transferred.....	.....	83,660.36	.....	.....	.....	.....	83,660.36
Postal receipts:	.....	.....	.....	.....	.....	.....	.....
Postage stamps.....	11,043.65	72,709.54	74,327.40	83,847.10	82,613.72	87,441.58	496,395.25
Stamp books.....	.....	.....	.....	.....	.....	199.87	199.87
Money-order fees.....	.....	19,309.14	21,720.93	22,657.29	23,457.98	22,871.68	120,246.62
Total postage receipts.....	11,043.65	92,018.68	96,048.33	106,804.39	106,071.70	110,513.13	616,841.74
Total.....	21,113.78	367,539.21	343,596.21	393,413.14	426,963.33	370,272.81	2,069,646.04

TABLE 20.—*Expenditures from July 1, 1905, to June 30, 1912.*

[This statement includes all outstanding audited claims, but does not include expenditures of money order, Y. M. C. A., nor trust funds.]

On account of—	July 1, 1905, to June 30, 1906.	July 1, 1906, to June 30, 1907.	July 1, 1907, to June 30, 1908.	July 1, 1908, to June 30, 1909.	July 1, 1909, to June 30, 1910.	July 1, 1910, to June 30, 1911.	July 1, 1911, to June 30, 1912.	Total.
PUBLIC IMPROVEMENTS.								
Roads and trails:								
Construction.....				\$66,601.60	\$191,003.66	\$34,588.54	\$46,105.01	\$340,569.97
Maintenance.....			\$2,271.16	4,669.61	15,208.75	15,302.52	19,639.50	54,820.38
Market houses:								
Construction.....			1,385.08	15,485.01	2,497.33	110.04	.....	19,478.06
Maintenance.....			1,467.33	5,476.14	686.77	532.89	1,099.50	9,202.63
Operation.....			1,133.29	2,238.52	1,862.58	1,610.46	1,835.31	8,680.16
Slaughter houses:								
Construction.....					197.82	776.88	18.02	992.72
Maintenance.....			221.97	1,576.68	224.67	393.93	66.20	2,483.45
Operation.....			325.00	1,027.96	1,309.25	1,500.00	1,622.09	5,784.30
Waterworks and sewers:								
Construction.....			4,279.53	16,561.44	25,011.23	2,203.54	2,034.79	50,090.53
Maintenance.....				315.85	1,904.16	682.86	4,669.53	7,572.40
Sanitation native villages.....			7,336.94	16,087.21	12,500.00	.....	.....	35,924.15
Street lighting.....			24.84	3,476.29	1,226.90	1,035.62	1,205.28	6,968.93
Miscellaneous public works:								
Construction.....				2,339.05	5,712.90	.....	780.96	8,832.91
Maintenance.....			25,093.37	16,018.83	1,425.63	330.27	1,292.10	52,850.23
Total public improvements.....		\$8,690.03	43,538.51	151,874.19	260,771.65	59,068.15	80,368.29	604,310.82
PUBLIC SCHOOLS.								
School houses:								
Construction.....			5,298.65	56,752.89	12,877.07	13,082.86	8,230.79	96,242.26
Maintenance.....			577.72	11,220.16	2,814.99	2,305.56	3,483.62	20,869.33
Rental.....		467.28	599.16	562.50	150.00	.....	.....	1,701.66
Salaries superintendent, teachers, and clerks.....		390.00	31,644.00	42,477.88	51,436.82	55,838.19	62,122.75	283,775.77
Janitor service.....		40,266.13	245.77	2,432.15	2,562.98	1,930.76	3,539.05	10,898.17
Furniture and equipment.....		245.77	187.46	3,383.02	1,925.07	1,535.26	8,030.65	15,293.57
Supplies.....		394.57	25.00	2,201.11	4,915.16	6,090.28	2,967.22	22,775.45
Traveling and miscellaneous.....		6,301.96	299.72	2,201.11	1,161.31	2,197.55	12,623.15	18,143.01
Total public schools.....		998.26	179.62	983.12	77,843.40	82,970.46	100,997.23	469,699.22
MAINTENANCE ADMINISTRATIVE DISTRICT.								
Tax collectors' salaries.....				11,117.00	11,730.82	4,038.32	.....	26,886.14
District judges.....				12,990.00	16,726.66	17,538.16	15,676.65	62,931.47

Supplies and miscellaneous.....				1,826.41	3,452.29	1,027.90	1,011.63	7,318.23
Equipment.....				409.42	5.10		39.01	453.53
Zone charity cases, maintenance.....				3,383.90	800.00	3,600.00	2,400.00	10,183.90
District prisoners' maintenance.....			43.40	8,154.19	15,485.00	11,591.32	12,503.21	47,781.12
Total maintenance administrative district.....			43.40	37,880.92	48,199.87	37,795.70	31,630.50	155,554.39
CONTINGENT EXPENSES.								
Gratuity discharged penitentiary prisoners.....				645.00	757.50	667.50	892.50	3,127.50
Election expenses.....				9,679.49				9,679.49
Miscellaneous.....	\$172.97	1,718.13	997.69	804.59	1,200.70	385.15	299.62	5,578.85
Total contingent expenses.....	172.97	1,718.13	1,162.69	11,129.08	1,958.20	1,052.65	1,192.12	18,385.84
POSTAL SERVICE.								
Purchase of stamps.....	9,993.89	37,766.11	31,160.00	38,460.00	29,400.00	28,075.60	31,711.42	206,567.02
Transportation mails:								
Isthmus.....				13,851.17	14,950.67	12,760.00	15,175.00	56,736.84
Ocean.....				13,958.00	17,419.28	10,782.56	40,722.19	82,882.03
Supplies and miscellaneous.....				5,486.67	10,417.19	7,508.03	10,663.00	34,074.89
Transfer to Isthmian Canal Commission as reimbursement in part for salaries paid.....					35,000.00	40,000.00		163,513.21
Total postal service.....	9,993.89	37,766.11	99,673.21	91,755.84	107,187.14	99,126.19	98,271.61	543,773.99
Total disbursements.....	10,166.86	97,281.64	183,189.74	412,632.86	495,960.26	280,013.15	312,459.75	1,791,724.26

TABLE 21.—*Revenues collected, Canal Zone funds, from July 1, 1911, to June 30, 1912.*

[This statement includes balances in hands of collecting officers, but does not include money orders, Y. M. C. A., nor trust funds.]

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
Aerated waters.....	\$739.60	\$2,440.80	\$1,200.40	\$1,478.80	\$5,859.60
Animal license.....	22.20	203.70	155.10	81.00	462.00
Auctioneers.....		12.00	8.00	9.00	29.00
Bicycle license.....	161.25	161.25	161.25	161.25	645.00
Building rentals.....	3,622.28	2,395.00	1,712.50	12.50	7,742.28
Burial permits.....	487.50	487.50	487.50	487.50	1,950.00
Cabs and coaches.....		171.25	2.75		174.00
Carts.....	691.50	1,055.00	113.00	2,301.00	4,160.50
Chauffeurs' license.....	24.25	24.25	24.25	24.25	97.00
Circuit court collections.....	2,122.74	2,122.74	2,122.75	2,122.75	8,490.98
Dance halls.....		100.00	30.00	30.00	160.00
Distilling license.....	858.18		4,190.93	34.60	5,083.71
District court collections.....	8,750.60	9,177.20	3,762.31	6,479.68	28,169.79
Gathering coconuts.....				599.70	599.70
Hucksters.....				93.20	93.20
Hunting permits.....	428.75	428.75	428.75	428.75	1,715.00
Insurance tax.....	271.96	271.95	271.96	271.96	1,087.83
Interest.....	5,196.25	5,196.24	5,196.23	5,196.24	20,784.96
Land rentals.....	1,475.65	4,978.18	1,524.52	591.45	8,569.80
Market rentals.....	385.40	2,730.30	703.60	380.60	4,199.90
Marshal fees.....	307.21	753.86	461.23	577.15	2,099.45
Merchandise and drugs.....	794.90	3,706.18	1,656.10	1,933.50	8,090.68
Motor-vehicle license.....	514.75	514.75	514.75	514.75	2,059.00
Peddling.....	1,204.00	3,452.50	1,047.50	2,463.50	8,167.50
Physicians' license.....	33.75	33.75	33.75	33.75	135.00
Police fines.....	113.46	113.45	113.46	113.46	453.83
Poll tax.....	110.00	478.00	70.00	350.40	1,008.40
Pond fees.....	143.23	185.88	97.30	104.06	530.47
Public entertainments.....	45.00	431.90	79.00	122.00	677.90
Real estate tax.....	3,052.10	15,758.37	3,685.00	9,582.64	32,078.11
Restaurants.....	168.00	403.00	218.80	286.20	1,076.00
Retail liquor license.....		28,400.00	10,089.88	9,600.00	48,089.88
Retail sale of tobacco.....	747.20	3,362.00	1,642.00	1,906.00	7,657.20
Sale of imported meats.....	5.25	3.70	.25	53.36	62.56
Sale of impounded animals.....	61.35	72.50	8.00	50.00	191.85
Sale of property.....	288.62	288.62	288.62	288.61	1,154.47
School tuition, lost or damaged books.....	219.05	219.06	219.06	219.06	876.23
Services district prisoners.....	6.66			25.20	31.86
Slaughter tax.....	47.00	10,872.50	739.50	736.00	12,395.00
Steamboat inspection.....	709.29	709.30	709.28	709.28	2,837.15
Water tax.....	1,716.28	11,582.90	3,767.16	12,946.55	30,012.89
Total.....	35,525.21	113,298.33	47,536.44	63,399.70	259,759.68
Sale of postage stamps.....					87,441.58
Sale of stamp books.....					199.87
Money-order fees.....					22,871.68
Total.....					370,272.81

TABLE 22.—*Expenditures, Canal Zone funds, from July 1, 1911, to June 30, 1912.*

This statement includes all outstanding audited claims, but does not include expenditures of money-order, Y. M. C. A., nor trust funds.]

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
<i>Public improvements.</i>					
Roads and trails:					
Construction.....	\$12,152.15	\$21,353.82	\$7,591.23	\$5,007.81	\$46,105.01
Maintenance.....	3,908.64	12,291.24	1,973.40	1,466.22	19,639.50
Market houses:					
Maintenance.....	97.63	647.98	291.93	61.96	1,099.50
Operation.....	420.87	570.72	430.54	413.18	1,835.31
Slaughterhouses:					
Construction.....		18.02			18.02
Maintenance.....		66.20			66.20
Operation.....	374.21	446.97	414.29	386.62	1,622.09
Waterworks and sewers:					
Construction.....	77.92	1,531.87	15.34	409.66	2,034.79
Maintenance.....	9.91	2,050.50	378.99	2,230.13	4,669.53
Street lighting.....	98.05	309.18	585.65	212.40	1,205.28
Miscellaneous public works:					
Construction.....	21.61	366.03		393.32	780.96
Maintenance.....	.78	1,247.46	32.45	11.41	1,292.10
<i>Public schools.</i>					
Schoolhouses:					
Construction.....	3,096.95	614.09	1,281.97	3,237.78	8,230.79
Maintenance.....	243.34	1,114.63	489.77	1,635.88	3,483.62
Salaries, superintendent, teachers, and clerks.....	15,530.67	15,530.66	15,530.71	15,530.71	62,122.75
Janitor service.....	620.50	1,233.25	715.30	970.00	3,539.05
Furniture and equipment.....	2,478.11	2,163.86	1,372.03	2,016.65	8,030.65
Supplies.....	612.13	813.86	458.86	1,082.37	2,967.22
Traveling and miscellaneous expense.....	4,554.50	3,199.62	1,746.26	3,122.77	12,623.15
<i>Maintenance, administrative districts.</i>					
Salaries, district judges.....	3,919.19	3,919.15	3,919.15	3,919.16	15,676.65
Supplies and miscellaneous.....	101.90	415.01	291.33	203.39	1,011.63
Equipment.....	22.24		3.97	12.80	39.01
Zone charity cases, maintenance.....	600.00	600.00	600.00	600.00	2,400.00
District prisoners, maintenance.....	3,431.69	4,606.96	2,085.50	2,379.06	12,503.21
<i>Contingent expenses.</i>	52,372.99	75,111.08	40,208.67	45,303.28	212,996.02
Gratuity penitentiary prisoners.....					892.50
Miscellaneous.....					299.62
<i>Postal service.</i>					
Purchase of stamps.....					31,711.42
Transportation of mails:					
Isthmus.....					15,175.00
Ocean.....					40,722.19
Miscellaneous expenses.....					10,663.00
Total.....					312,459.75

TABLE 23.—*Statement of balances in treasury, by appropriations, June 30, 1912.*

Public improvements and schools.....	\$219,883.60
Miscellaneous and contingent.....	8,749.74
Postal receipts, 1912.....	30,468.82
Money-order funds.....	766,828.15
Y. M. C. A. funds.....	22,389.57
Trust funds.....	7,848.14
Postal savings funds.....	347,879.00
Invalidated money orders.....	2,012.66
Total.....	1,406,059.68

TABLE 24.—Statement showing total value of money orders issued, money orders paid, money orders outstanding, and balance of money-order funds, June 30, 1912.

POSTAL SERVICE.

Year ending June 30—	Money orders issued.				Total.
	United States.	Canal Zone.	Martinique.	Costa Rica.	
1907.....	\$2,067,358.87	\$301,672.62	.....	.....	\$2,369,031.49
1908.....	3,460,755.25	1,225,929.73	.....	.....	4,686,684.98
1909.....	3,783,090.44	1,383,659.02	.....	.....	5,166,749.46
1910.....	3,976,883.08	1,247,610.22	\$4,060.30	.....	5,228,553.60
1911.....	4,014,819.20	1,283,403.12	6,239.78	\$444.50	5,304,906.60
1912.....	3,823,517.52	1,080,825.74	8,604.95	2,129.05	4,915,077.26
Total.....	21,126,424.36	6,523,100.45	18,905.03	2,573.55	27,671,003.39

Year ending June 30—	Money orders paid by—				Total.
	United States.	Canal Zone.	Martinique.	Costa Rica.	
1907.....	\$1,581,251.91	\$208,165.48	.....	.....	1,789,417.39
1908.....	2,875,719.61	1,017,750.97	.....	.....	3,893,470.58
1909.....	3,583,419.57	1,492,144.76	.....	.....	5,075,564.33
1910.....	4,068,650.16	1,331,568.20	\$2,267.60	.....	5,402,486.26
1911.....	3,725,996.12	1,337,915.09	6,022.08	.....	5,069,933.29
1912.....	3,521,511.95	1,280,397.88	8,176.95	\$1,062.40	4,811,149.18
Total.....	19,356,549.32	6,667,942.38	16,466.63	1,062.40	26,042,021.03

SUMMARY.

Total money orders drawn:	
On the United States.....	\$21,126,424.36
On the Canal Zone.....	6,523,100.45
On Martinique.....	18,905.03
On Costa Rica.....	2,573.55
	\$27,671,003.39
Total money orders paid:	
By the United States.....	19,356,549.32
By the Canal Zone.....	6,667,942.38
By Martinique.....	16,466.63
By Costa Rica.....	1,062.40
Total outstanding:	
Drawn on the United States.....	1,413,695.54
Drawn on the Canal Zone.....	211,980.57
Drawn on Martinique.....	2,112.40
Drawn on Costa Rica.....	1,194.15
	27,671,003.39
Money-order funds remitted to the United States.....	19,879,249.17
United States orders paid in the Canal Zone.....	316,538.90
Money-order funds remitted to Martinique.....	16,121.01
Martinique orders paid in the Canal Zone.....	721.25
Money-order funds remitted to Costa Rica.....	1,016.95
Costa Rica orders paid in the Canal Zone.....	85.70
	20,213,732.98
Money orders drawn on and paid in the United States.....	19,356,549.32
Money orders drawn on and paid in Martinique.....	16,466.63
Money orders drawn on and paid in Costa Rica.....	1,062.40
Funds in hands of Postmaster General United States.....	839,238.75
Due from Martinique post office department.....	375.63
Due from Costa Rica post office department.....	40.25
	20,213,732.98
MONEY ORDERS OUTSTANDING.	
Drawn on the United States.....	1,413,695.54
Drawn on the Canal Zone.....	211,980.57
Drawn on Martinique.....	2,112.40
Drawn on Costa Rica.....	1,194.15
	1,628,982.66
MONEY-ORDER FUNDS.	
Cash in hand, Canal Zone treasurer.....	766,828.15
Cash in hands of postmasters.....	20,485.22
Cash in hand, Canal Zone treasurer, account invalid orders.....	2,014.66
Due from United States Post Office Department.....	839,238.75
Due from Martinique post office department.....	375.63
Due from Costa Rica post office department.....	40.25
	1,628,982.66

TABLE 25.—Statement of money-order business, postal savings, and stamp sales, fiscal year ended June 30, 1912.

Post office.	Amount issued.	Drawn on—			
		United States.	Canal Zone.	Martinique.	Costa Rica.
Ancon.....	\$509,737.94	\$448,375.76	\$60,212.08	\$975.95	\$174.15
Balboa.....	230,888.06	174,242.42	56,557.24	74.00	14.40
Bas Obispo.....	84,019.95	58,025.43	25,822.02	172.50	.....
Corozal.....	206,172.60	144,207.92	61,899.68	.....	65.00
Cristobal.....	816,425.10	730,621.42	84,796.28	440.40	567.00
Culebra.....	311,549.92	236,011.64	74,831.28	607.00	100.00
Empire.....	434,771.43	364,974.57	68,011.86	1,536.50	248.50
Gatun.....	708,974.71	504,020.73	204,472.48	239.50	242.00
Gorgona.....	517,408.11	384,811.48	130,447.63	2,137.00	12.00
Las Cascadas.....	223,540.93	173,959.34	49,524.59	57.00	.....
Matachin.....	45,343.46	30,541.62	14,484.84	302.00	15.00
Miraflores.....	125,542.64	73,873.74	50,954.80	228.10	486.00
Paraiso.....	196,002.64	134,635.14	61,157.50	210.00	.....
Pedro Miguel.....	379,864.21	280,248.86	98,090.85	1,399.50	125.00
San Pablo.....	6,577.60	3,988.31	2,477.79	111.50	.....
Tabernilla.....	13,486.76	9,803.05	3,661.71	22.00	.....
Station A.....	62,497.23	41,473.80	21,023.43	.....	.....
Station B.....	42,273.97	29,702.29	12,399.68	92.00	80.00
Total.....	4,915,077.26	3,823,517.52	1,080,825.74	8,604.95	2,129.05

Money orders paid and repaid in Canal Zone post offices.							
Post office.	United States orders, paid.	Drawn on United States, repaid.	Martinique.		Costa Rica.		Canal Zone, paid.
			Paid.	Repaid.	Paid.	Repaid.	
Ancon.....	\$16,780.71	\$6,434.30	\$38.83	\$43.00	\$40.25	\$15.00	\$102,177.93
Balboa.....	1,836.88	2,316.71	.....	.....	.....	.....	56,361.77
Bas Obispo.....	1,753.65	1,089.50	.....	.....	.....	.....	21,003.89
Corozal.....	1,832.21	1,650.79	.....	.....	.....	40.00	47,532.68
Cristobal.....	17,307.70	6,546.40	256.62	25.00	.....	122.00	205,561.07
Culebra.....	5,921.00	2,800.91	19.99	.....	45.45	20.00	75,187.06
Empire.....	10,706.21	5,036.54	29.13	.....	.....	.....	92,288.64
Gatun.....	6,189.90	6,498.44	.....	8.00	.....	70.00	185,353.25
Gorgona.....	12,061.24	11,466.76	.....	100.00	.....	50.00	127,690.71
Las Cascadas.....	4,305.79	5,438.55	.....	.....	.....	.....	59,697.93
Matachin.....	481.72	377.65	.....	3.00	.....	.....	12,672.97
Miraflores.....	554.89	797.55	.....	.....	.....	.....	51,151.56
Paraiso.....	2,124.58	3,817.14	.....	.....	.....	.....	48,008.95
Pedro Miguel.....	1,901.80	3,935.18	31.06	.....	.....	.....	104,669.99
San Pablo.....	.....	17.50	.....	.....	.....	.....	2,172.17
Tabernilla.....	490.00	664.22	.....	.....	.....	.....	2,949.46
Station A.....	369.50	197.85	.....	.....	.....	.....	7,601.55
Station B.....	431.20	158.20	.....	.....	.....	.....	6,747.60
Invalidated.....	.....	1,154.50	.....	.....	.....	.....	10,674.01
Total.....	85,048.98	60,398.69	375.63	179.00	85.70	317.00	1,219,503.19

TABLE 25.—Statement of money-order business, postal savings, and stamp sales, fiscal year ended June 30, 1912—Continued.

Post office.	Postal receipts.		Postal savings bank transactions.		
	Money-order fees.	Stamp sales.	Deposits.	Withdrawals.	Balance.
Ancon.....	\$2,532.04	{ \$14,627.35 1 116.61 }	\$31,751.00	\$14,231.00	\$17,520.00
Balboa.....	1,019.52	3,530.00	47,076.00	19,781.00	27,295.00
Bas Obispo.....	426.59	1,471.00	3,425.00	1,650.00	1,775.00
Corozal.....	869.58	2,075.00	48,674.00	19,130.00	29,544.00
Cristobal.....	3,838.77	{ 18,189.71 1 26.23 }	42,494.00	17,264.00	25,230.00
Culebra.....	1,531.32	6,538.75	52,692.00	25,417.00	27,275.00
Empire.....	2,166.20	9,084.00	40,269.00	9,327.00	30,942.00
Gatun.....	3,282.94	12,280.00	56,105.00	22,986.00	33,119.00
Gorgona.....	2,253.56	5,380.75	101,815.00	45,561.00	56,254.00
Las Cascadas.....	1,043.27	{ 4,136.00 1 1.40 }	48,653.00	24,223.00	24,430.00
Mataehin.....	268.63	1,088.00	3,446.00	1,028.00	2,418.00
Miraflores.....	553.61	1,560.75	23,634.00	6,881.00	16,753.00
Paraiso.....	900.57	2,675.00	21,136.00	9,476.00	11,660.00
Pedro Miguel.....	1,609.59	3,135.95	81,478.00	33,501.00	47,977.00
San Pablo.....	38.40	191.23			
Tabernilla.....	72.69	292.67			
Station A.....	282.98	718.50	3,278.00	1,037.00	2,241.00
Station B.....	199.67	613.00	3,980.00	1,466.00	2,514.00
Bohio.....		127.55			
Monte Lirio.....		10.00			
D. Q. M. Mount Hope.....		372.00			
Total.....	22,889.93	87,641.45	609,906.00	252,959.00	356,947.00

¹ Newspaper postage.

TABLE 26.—Statement showing the monthly money-order business of the Canal Zone postal service, fiscal year ended June 30, 1912.

Month.	Drawn on—					Fees.	Orders issued.	Money orders paid and repaid in the Canal Zone.										Cash remittances to United States Post Office Department.
	United States.							Canal Zone orders paid in.					United States.					
	United States.	Canal Zone.	Martinique.	Costa Rica.	Costa Rica.			Martinique.	Costa Rica.	Issued in Canal Zone, paid in Canal Zone.								
1911.																		
July.....	\$407,397.91	\$1,811.04	\$305,895.68	\$100,969.73	\$372.50											\$160.00		
August.....	420,193.89	1,859.22	319,212.76	100,110.13	611.00											260.00		
September.....	451,216.02	2,039.28	340,976.06	109,328.56	779.50											131.90		
October.....	417,576.83	1,893.10	305,827.83	110,781.39	907.61											60.00		
November.....	487,090.57	2,303.21	370,540.80	115,603.22	636.55											310.00		
December.....	427,483.48	2,051.27	328,981.20	97,800.32	600.71											101.25		
1912.																		
January.....	404,891.70	1,873.79	302,635.93	101,404.02	691.75											160.00		
February.....	418,419.66	1,991.56	346,660.26	70,527.50	1,048.90											183.00		
March.....	375,695.68	1,790.53	311,604.49	63,263.94	568.25											259.00		
April.....	363,627.50	1,739.37	292,427.16	70,322.06	643.88											234.40		
May.....	395,885.59	1,879.40	319,392.40	75,159.59	1,099.60											234.00		
June.....	345,598.43	1,657.96	279,362.95	65,555.28	644.70											35.50		
Total.....	4,915,077.26	22,889.93	3,823,517.52	1,080,825.74	8,904.95											2,129.05		
Month.	Canal Zone orders paid in.										United States.	Cash remittances to United States Post Office Department.						
	United States orders paid.	Canal Zone on United States, repaid.	Martinique.	Costa Rica.		Issued in Canal Zone, paid in Canal Zone.	Martinique.	Costa Rica.										
1911.																		
July.....	\$4,351.73	\$4,904.29	\$17.47	\$25.00	\$1.75	\$113.00	\$111,748.58									\$400,000.00		
August.....	5,976.37	6,046.62	29.13			15.00	103,798.17									275,000.00		
September.....	4,759.26	5,696.32				20.00	121,890.92									265,000.00		
October.....	7,933.47	4,059.08					80,699.30									435,000.00		
November.....	8,115.83	5,243.30					115,149.19									390,000.00		
December.....	7,297.30	3,791.71	61.04		45.45	22.00	102,616.21											
1912.																		
January.....	4,694.84	4,772.56				50.00	81,949.15									430,000.00		
February.....	6,044.19	4,290.01	6.79	11.00	10.00	15.00	143,680.58									260,000.00		
March.....	7,651.87	7,603.70				30.00	90,414.44									275,000.00		
April.....	11,617.95	6,285.28	190.72	43.00		52.00	89,065.26									225,000.00		
May.....	10,272.89	4,189.46	38.83		28.50		102,729.64									330,000.00		
June.....	7,833.28	3,516.36	31.65				75,761.75									295,000.00		
Total.....	85,048.98	60,398.69	375.63	179.00	85.70	317.00	1,219,503.19									3,580,000.00		

TABLE 27.—*Statement of increases in number of persons employed and increases in compensation during fiscal year 1912, required by act of Mar. 4, 1911.*

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 book esti- mates.	Maximum number employed at any one time during fiscal year 1912.	Explanation of increases.
Claim officer.....	\$2,700.00	.....	1	1	Salary increased from \$2,400 on account of increased duties and responsibilities under sec. 5, act Mar. 4, 1911, transferring to chairman the duty of settling claims for compensation on account of injury and death, previously vested in Secretary of Commerce and Labor.
Clerk.....	2,100.00	4	4	5	Salary 1 clerk, Injury Claims Division, increased from \$1,800 to \$2,100 for reasons stated opposite claim officer.

APPENDIX M.

REPORT OF EDWARD J. WILLIAMS, DISBURSING OFFICER.

ISTHMIAN CANAL COMMISSION, DISBURSING DEPARTMENT, *Empire, Canal Zone, July 18, 1912.*

SIR: I have the honor to submit the following report of the disbursing department on the Isthmus for the fiscal year ended June 30, 1912.

The Panama currency has been of sufficient volume during the past year to care for the labor payments and the supply of American currency on the Isthmus has been sufficient for our needs, it having only been necessary during the past year to bring down from the United States \$18,500 in fractional silver coins.

Herewith please find statement No. 1, showing by months and grand totals for the fiscal year the amounts actually paid out on gold rolls, \$8,826,471.79; silver rolls, \$10,580,927.11; public bills and reimbursement vouchers, \$10,465,634.09; a grand total of \$29,873,032.99. The total number of payments on the gold pay rolls was 64,062, and on the silver rolls 392,115, or a total of employees paid compensation during that time of 456,177.

Statement No. 2, gives the number and value of hotel books, commissary books, and meal tickets issued from this office to the various departments, by months, for the fiscal year—a total valuation of \$4,591,510.50.

Respectfully,

EDWARD J. WILLIAMS,
Disbursing Officer.

Col. GEO. W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

STATEMENT 1.—*Payments made by the disbursing department on the Isthmus during the fiscal year 1912.*

Months.	Gold rolls.	Silver rolls.	Public bills and reimbursement vouchers.	Total.	Items on roll each month.		
					Gold.	Silver.	Total.
1911.							
July.....	\$726,624.21	\$808,646.36	\$497,841.19	\$2,033,111.76	5,219	31,443	36,662
August.....	767,546.85	816,440.77	1,718,786.29	3,302,773.91	5,198	32,301	37,499
September.....	709,423.19	881,694.59	714,286.47	2,305,404.25	5,302	32,958	38,260
October.....	737,712.56	878,844.51	990,196.59	2,606,753.66	5,271	33,243	38,514
November.....	725,526.35	899,396.54	774,056.12	2,398,979.01	5,324	32,606	37,930
December.....	734,046.71	865,739.77	910,395.98	2,510,182.46	5,283	32,300	37,583
1912.							
January.....	732,629.16	894,831.98	738,520.53	2,365,981.67	5,293	33,152	38,445
February.....	746,910.77	921,823.65	822,206.84	2,490,941.26	5,449	33,272	38,721
March.....	746,010.01	884,372.33	847,186.38	2,477,568.72	5,599	33,089	38,688
April.....	745,407.08	941,102.75	859,190.26	2,545,700.09	5,542	33,215	38,757
May.....	736,347.71	895,623.35	660,595.86	2,292,566.92	5,272	32,639	37,911
June.....	718,287.19	892,410.51	932,371.58	2,543,069.28	5,310	31,897	37,207
Total.....	8,826,471.79	10,580,927.11	10,465,634.09	29,873,032.99	64,062	392,115	456,177

In addition to the above \$2,895,416.02, miscellaneous collections, was deposited with the Assistant Treasurer of the United States, New York, N. Y.

STATEMENT 2.—*Coupon books and meal tickets issued by the disbursing department on the Isthmus during the fiscal year 1912.*

Months.	Commissary books.			Hotel books.		Meal tickets.		
	\$2.50	\$5	\$15	\$4.80	\$15	27 cents.	40 cents.	Re-cruit-ing.
1911.								
July.....	6,190	22,585	6,520	495	3,320	33,500	88,300	.....
August.....	8,940	27,745	6,225	260	2,265	27,500	71,600	1,500
September..	9,045	28,095	5,940	900	3,665	101,900	105,600	1,900
October.....	9,676	28,760	6,371	415	4,495	45,000	125,100	2,100
November..	10,750	29,910	6,875	885	2,300	46,500	79,300	1,000
December...	10,129	29,055	7,260	270	2,575	35,700	90,000	1,200
1912.								
January.....	10,420	29,650	6,874	285	4,205	28,800	101,200	1,200
February...	14,265	27,895	6,775	585	4,320	52,700	133,500	1,800
March.....	10,550	28,395	7,025	885	3,250	26,200	66,800	1,500
April.....	10,595	31,575	6,650	335	4,530	61,300	105,700	600
May.....	12,340	31,090	10,090	770	6,090	40,800	66,100	2,000
June.....	9,295	30,325	5,920	480	4,520	51,400	115,200	7,500
Total books.	122,195	345,080	82,525	6,565	45,535	551,300	1,148,400	22,300
Value.....	\$305,487.50	\$1,725,400.00	\$1,237,875.00	\$31,512.00	\$683,025.00	\$148,851.00	\$459,360.00	.....
Total value.		\$3,268,762.50		\$714,537.00		\$608,211.00		*

Making a grand total value of \$4,591,510.50.

APPENDIX N.

REPORT OF HON. M. H. THATCHER, MEMBER OF ISTHMIAN CANAL COMMISSION, HEAD OF THE DEPARTMENT OF CIVIL ADMINISTRATION.

DEPARTMENT OF CIVIL ADMINISTRATION,
ISTHMIAN CANAL COMMISSION,
Ancon, Canal Zone, August 1, 1912.

SIR: I have the honor to submit herewith the report of the department of civil administration of the commission for the fiscal year ended June 30, 1912. The organization of the department remains substantially as described in the last annual report. The department comprehends the divisions of posts, customs and revenues, police and prisons, fire protection, public works, steam-vessel inspection service, schools, the Canal Zone treasurer, and the courts.

LEGISLATION.

No legislation affecting the Canal Zone was enacted by Congress during the period covered by this report.

Sixteen Executive orders signed by the President or the Secretary of War, having the effect of law in the Canal Zone, were issued during the year. Among the most important of these are the following: The order of July 21, 1911, providing for the inspection of all steam vessels navigating the waters of the Canal Zone; the order of September 8, 1911, establishing a postal savings system in the Canal Zone; the order of November 15, 1911, to prevent the unauthorized purchase of supplies and equipment from persons in the Army or Navy; the order of January 12, 1912, providing for the taking of a census of the Canal Zone; the order of February 5, 1912, to provide an inexpensive method for the administration of estates of deceased and insane persons in certain cases; the order of February 8, 1912, providing a maximum speed for motor vehicles in the Canal Zone and establishing a rule of the road; the order of April 17, 1912, prohibiting trespassing upon reservations under the control of the United States of America, Canal Zone government, or the Panama Railroad Co., and the order of May 21, 1912, amending the Executive order of May 13, 1911, respecting the collection of a distillation tax in the Canal Zone, section 2 of which prohibits the manufacture or distillation of alcoholic spirits after January 1, 1913.

Five ordinances were enacted by the Isthmian Canal Commission and approved by the Secretary of War during the year. The more important of these are: The ordinance enacted by the commission August 5, 1911, and approved by the Secretary of War August 22, 1911, establishing market regulations for the Canal Zone; and the ordinance enacted by the commission April 9, 1912, and approved by the Secretary of War May 1, 1912, amending the ordinance enacted by the commission on August 25, 1910, respecting the licensing and

regulation of motor vehicles in the Canal Zone, establishing a reciprocal license tax upon motor vehicles licensed in the Canal Zone and the Republic of Panama.

I drafted and assisted in drafting a number of these Executive orders and ordinances and recommended their promulgation or enactment. These Executive orders and ordinances are set forth in full in the appendices appearing at the close of this report.

RELATIONS WITH PANAMA AND FOREIGN REPRESENTATIVES.

Negotiations by correspondence or personal conference between the head of the department of civil administration and the secretary of foreign affairs of the Republic of Panama included, among others, the following subjects in addition to routine matters: The charging of fees by Panaman consuls in San Francisco for the certification of manifests covering shipments destined for the port of Ancon; the adoption of laws and regulations by the Republic of Panama governing the navigation of waters under the jurisdiction of the Republic uniform with those of the Canal Zone; the occupancy of public lands of the Republic by persons forced to vacate lands in the section of the Canal Zone to be inundated by the waters of Gatun Lake; the exercise of Canal Zone jurisdiction over Gatun Lake areas lying within the territory of the Republic; the operation of the Chinese exclusion law in the Republic and the Canal Zone; readjustment of automobile license taxes in the Republic and the Canal Zone; reputed inconvenience and damage to property owners at Nombre de Dios by commission operations there; interference with United States mails in the city of Colon; the purchase of postage stamps; the transfer by the Panama Railroad Co. to the Panaman Government of certain lots in exchange for land situated opposite the Hotel Tivoli; the operation of schools for Panaman children by the Government of Panama within the Canal Zone; extradition to the Canal Zone of persons charged with engaging in the white-slave traffic and with other offenses; the extradition of persons charged with crime from the Canal Zone to Panama; the enforcement of the white-slave law; the deportation of gamblers and other undesirable characters living in Panama and Colon; the operation of saloons in Colon in proximity to the Zone line; the relocation of the restricted district in the city of Panama; enforcement of the laws of the Republic prohibiting the recruiting of laborers; the regulation and supervision of pawn-broking establishments in Panama and Colon; attempted exercise of police authority on Zone territory by police officers of the Republic of Panama; reciprocal execution of letters rogatory; the administration of estates of citizens of Panama who die in the Canal Zone; the celebration of marriages in the Republic of Panama by Protestant ministers; the customs inspection of baggage at the Panama city railroad station by officials of the Republic; improved fire protection facilities and better prison accommodations in the cities of Panama and Colon, and the enforcement of sanitary, quarantine, and immigration laws and regulations in the two cities; the repatriation of alien patients confined in the insane asylum at Ancon at the expense of the Panaman Government; improved street cleaning and garbage-removal service in the city of Panama; the construction of buildings, streets, sewers, and other improvements and the maintenance of

proper water service in the cities of Panama and Colon; and the promulgation of additional sanitary and building regulations therein.

Correspondence and negotiations of the general character described in the last annual report were also had with the various diplomatic and consular representatives accredited to the Republic of Panama.

The relations of the commission and the Canal Zone government with the Republic of Panama and with foreign representatives continue satisfactory.

EXECUTIVE OFFICE.

The organization of the office of the head of the department of civil administration consists of 1 chief clerk, 1 assistant chief clerk, 18 clerks, 1 storekeeper, 1 translator, and 2 messengers.

In addition to the regular work performed in the executive office there was placed under the department of civil administration and directed from the executive office the taking of a census of the Canal Zone, authorized by the order of the President of January 12, 1912. The assistant chief clerk of the department and two census experts from the Bureau of the Census at Washington had direct charge of the work under the general supervision of the head of the department.

The territorial scope of the census embraced the Canal Zone proper and also the commission settlements at Porto Bello, Nombre de Dios, Colon Beach (including Colon Hospital), and the Taboga Sanitarium, and the total enumeration of this territory was designated as the Canal Zone population and totaled 62,810. The enumeration, in addition to covering the Canal Zone and settlements named, also included all employees of the Isthmian Canal Commission, the Panama Railroad Co., and of canal contractors employed in the Canal Zone who, on the enumeration date, resided in the cities of Panama and Colon (outside of Colon Beach), and aggregated 8,872. The persons so enumerated in the cities of Panama and Colon are not included in the total population shown for the Canal Zone. The total enumeration, therefore, was 71,682.

The Canal Zone was divided into four supervisors' districts coextensive with the administrative districts of Ancon, Empire, Gorgona, and Cristobal, the work in each district being placed in charge of a district supervisor. The enumeration work in Porto Bello, Nombre de Dios, and Colon Beach was under the supervision of the Cristobal district supervisor, and that of Taboga was under the supervision of the Ancon district supervisor. The enumeration was commenced simultaneously in all districts on February 1, 1912, with a field force of 30 enumerators, and was completed on March 30, 1912. Then followed the work of tabulation.

Of the total population of 62,810 for the Canal Zone, as above defined, 19,413 are white, 31,525 black, 10,323 mixed, 648 Indian, 521 yellow, 378 Hindoos, and 2 Filipinos.

Classified by citizenship, Great Britain leads with 30,859. The United States is next with 11,850. Among the other principal nations represented are Panama, 7,636; Spain, 4,305; France (largely French West Indians), 2,760; Colombia, 1,521; Italy, 812; and China with 516. Of the 11,850 American citizens, 9,770 were born in the United States. Distributed by States, the principal ones are Pennsylvania, 1,375; New York, 1,372; Ohio, 692; Illinois,

453; Massachusetts, 386; Indiana, 382; Kentucky, 369; and Virginia, 338.

The number of employees of the commission and the Panama Railroad is given as 42,174. Of that number, 9,661 reside in the cities of Panama and Colon and are not, therefore, included in the population figures for the Zone. Of the number of employees above given, 33,241 are employed by the Isthmian Canal Commission and 8,933 by the Panama Railroad Co.

Because of the complex and shifting population to be enumerated, many difficulties were encountered in the enumeration work, but every effort was made and every precaution taken to insure fullness and accuracy, and the result has been a satisfactory one.

The total cost of the census, exclusive of the expenses of publication of the census report and population tables, is \$12,815.74. Abstracts of the population tables for the Canal Zone will be found in Appendix X.

STEAMBOAT-INSPECTION SERVICE.

The organization of the board of local inspectors was increased during the year by the creation of the position of deputy hull and boiler inspector. This increase in the organization of the board was made necessary to provide for the inspection of steam vessels placed under the direction of the board of local inspectors by the order of the President of July 21, 1911, which became effective November 14, 1911.

During the year the board issued 34 licenses to pilots, 9 to masters—4 of which were issued as joint master-pilot licenses, 10 to mates, and 11 to engineers; a total of 64 licenses.

Sixteen convictions were secured for violation of the rules for the navigation of the Panama Canal and auxiliary waters, adopted by the Isthmian Canal Commission on December 5, 1910, and approved by the Secretary of War on December 21, 1910.

Under the authority of the chairman's circular No. 371, dated January 28, 1911, approved by the Secretary of War, the board made two semiannual inspections of the floating plant of the commission and the Panama Railroad Co., and made such recommendations as would bring the floating plant up to the required standard of efficiency.

Inspections of steam vessels under the provisions of the Executive order of July 21, 1911, effective November 14, 1911, were made of 65 vessels of all classes, including ocean-going merchant vessels, tugs, etc., and 20 certificates were issued by the board to vessels of over 100 tons burden, and 41 to launches and other craft of less than 100 tons burden. The sum of \$2,837.15 was collected by the collector of revenues in fees for the issuance of the certificates of inspection.

The board of local inspectors also issued, between July 1, 1911, and November 14, 1911, under the provisions of the law then in force, 15 certificates of seaworthiness to launches.

Ninety-seven chauffeurs' licenses were also issued by the board under the provisions of the ordinance enacted by the Isthmian Canal Commission on April 15, 1911, and approved by the Secretary of War on April 26, 1911.

DIVISION OF POSTS, CUSTOMS, AND REVENUES.

This division includes the postal, customs, and public land services, the assessment and collection of taxes and license fees, and the administration of estates of deceased employees of the commission and Panama Railroad Co. The organization of this division consists of 1 collector of revenue (ex officio director of posts), 4 deputy collectors of revenues, 7 inspectors, 19 clerks, 2 messengers, 20 postmasters, 6 assistant postmasters, 31 postal clerks, 18 post-office messengers, 1 inspector of post offices, and 5 railway mail messengers.

POSTAL SERVICE.

During the year for which this report is submitted the sale of postage stamps and postal cards amounted to \$87,550.21, and \$144.20 was collected for second-class mail matter. The total income from postal sales was \$87,694.41, as compared with \$82,893.72 for the preceding fiscal year, representing an increase of \$4,800.69, while the increase over the fiscal year ended June 30, 1910, is \$3,847.31.

During the month of November, 1911, there were placed on sale at all the post offices stamp books containing 12 or 24 two-cent stamps or 24 one-cent stamps, which are sold at one cent more than the face value of the stamps contained in the book. The cost of printing and binding, the latter work being done in the office of the director of posts, is about one-third of a cent per book. Twenty-nine thousand nine hundred and seventy-nine books have been made up, of which 19,763 were actually sold to the public, producing a net revenue of \$131.76, the cost of manufacture, etc., being \$65.87.

At Cristobal during the year there were 1,235 dispatches of mail. During the same period 145,633 registered letters and parcels were handled at the post offices of the Zone. Of this number 22,477 were domestic letters, 6,549 domestic parcels, 43,823 foreign letters, 1,703 foreign parcels, 69,144 official letters and parcels registered free, and 1,937 letters and parcels reregistered free. Forty-seven per cent of the registered mail matter was official, and therefore franked and carried free. The total number of registered letters and parcels handled represents an increase of 4,408 over the previous fiscal year.

The post offices at Cristobal and Ancon as exchange offices handled 89,894 pieces of registered mail. Of these, 5,491 passed through the Ancon post office to and from Panama and Central and South American points, and 84,403 through the Cristobal post office to and from points in the United States, West Indies, and Europe. Sixty-four thousand and ninety-nine pouches, sacks, and registered sacks were handled by the railway mail messengers during the year.

Two hundred and twenty-seven thousand six hundred and eighty money orders were issued during the year for a total of \$4,915,077.29, and the fees aggregated \$22,889.90. The number and amount of money orders sold during the past year compared with the preceding fiscal year showed an increase of 12,900 in the number of orders issued and a decrease of \$389,829.31 in the amount of money involved. The amount of the collections from money-order fees amounted to \$565.19 less than for the preceding year. The average amount of each order issued was \$21.15, as compared with \$24.69 for the fiscal year ended

June 30, 1911. There were paid and repaid during the year orders amounting to \$1,354,079.68, as compared with \$1,397,119.96 for the previous fiscal year. Of the money orders sold during the year orders amounting to \$3,823,517.55 were payable in the United States and foreign countries, except Martinique and Costa Rica, where \$8,604.95 and \$2,129.05, respectively, were payable, and orders amounting to \$1,080,825.74 in the Canal Zone.

Under the Executive order dated September 8, 1911, which became effective November 8, 1911, a postal savings system was established in the post offices of the Canal Zone, to be operated without the payment of interest on the deposits, under such rules and regulations as should be adopted. Section 2 of that order creates a board of trustees, consisting of the collector of revenues of the Canal Zone, the auditor of the Canal Zone government, and the treasurer of the Canal Zone, for the control, supervision, and administration of the postal savings depository offices. Rules and regulations for the government of the system were adopted by the board and approved by the chairman, and the system inaugurated at the 16 post offices in the Canal Zone on February 1, 1912. During the five months in which the depositories have been in operation 3,518 accounts were opened, 2,402 of which remained open at the close of the year, with total deposits aggregating \$356,947. The total amount deposited in postal savings accounts during the same period was \$600,898, while the withdrawals aggregated \$243,951. There were in the post offices of the Canal Zone on June 30, 1911, unpaid money orders aggregating \$332,141.60, drawn to the order of the remitter, and payable at the office of issue. This sum represented the extent to which Zone post offices were used as depositories at the close of the fiscal year 1911. In like manner, the net total of postal savings deposits (\$356,947) and of unpaid money orders drawn to remitters and payable in offices of issue (\$193,817.40) in Canal Zone post offices on June 30, 1912, aggregating the sum of \$550,764.40, represent the extent to which Zone post offices were used as depositories at the close of the fiscal year just ended, and is an increase of \$218,622.80 over the total shown at the close of the fiscal year 1911. These totals, or practically the whole of them, represent savings of employees of the Isthmian Canal Commission and Panama Railroad Co., and the fact speaks well for the thrift of the employees. In the formulation of the laws and regulations governing these postal operations and in their administration, everything possible has been done to accommodate the employees and to inspire in them the practice of saving their earnings. The 2,402 postal savings depositors having opened accounts on June 30, 1912, represent 30 different nations and dependencies.

Effective July 1, 1911, the post offices at Porto Bello and Toro Point, officially designated as Cristobal Station A and Cristobal Station B, were made independent offices, and money-order systems were installed at each office. Because of the removal of all settlements from the Gatun Lake area and the consequent abandonment of the towns of San Pablo, Tabernilla, and Bohio, the post offices at these points were discontinued during the year. A new post office was established at Monte Lirio, making, at the close of the year, a total of 17 post offices in the Zone, or two less than at the close of the previous fiscal year.

In the office of the director of posts the usual amount of correspondence relating to postal business was handled, which consists

largely of correspondence with foreign postal administrations on money-order and registry matters, the issuance of duplicate money orders, and the return to countries of origin of unclaimed ordinary mail matter, of which there were 39,041 pieces, 10,487 being domestic letters and parcels and 28,554 foreign letters and parcels. One thousand nine hundred and ninety-nine misdirected letters were advertised in the Canal Record, of which about 60 per cent were delivered or forwarded to addressees.

CUSTOMS SERVICE.

During the year 327 vessels entered the port of Ancon with a total tonnage of 619,422, and 327 vessels cleared having a tonnage of 622,023. At Cristobal 284 vessels entered with a tonnage of 784,156 and 282 vessels cleared with a tonnage of 775,445.

The usual customs services were rendered seamen and vessels, and the interests of the Republic of Panama were guarded by customs inspectors on the wharves who prevented smuggling and the entrance of dutiable articles until the proper duties had been paid to the Panama authorities.

At the port of Ancon there arrived, in transit to the Republic of Panama or other countries, 172 aliens whose entry is prohibited under the exclusion laws. Of this number 116 were permitted to disembark by authority of the secretary of foreign affairs of the Republic of Panama, and 56 were either transferred to other vessels or returned to the port of embarkation.

LANDS AND BUILDINGS.

At the close of business on June 30, 1912, there were in force 858 leases and revocable licenses, of which 575 leases and licenses were for building lots and 258 leases for agricultural lands, and 25 for buildings or rooms in buildings, a decrease of 1,383 in the number of leases as compared with June 30, 1911. There has been a decrease in the area of land leased for agricultural purposes by reason of the removal of all habitations from that area in the Canal Zone which will be flooded by Gatun Lake, as well as for the reason that lands in other parts of the Zone are being required for canal purposes, or have been otherwise withdrawn from leasing. The area of agricultural land under lease at the close of the year was 352 hectares, or approximately 870 acres, as compared with 1,430 hectares, or approximately 3,534 acres, under lease at the close of the preceding fiscal year. Rents collected during the year amounted to \$16,033.54, as compared with \$23,469.22 for the year ended June 30, 1911. The total collections from this source for the previous years were, in 1910, \$27,282.29; in 1909, \$26,969.88; and in 1908, \$17,436.76. The collections from land rentals represent a decrease of \$10,550.44 from those of the previous year, while the rental from buildings and rooms shows an increase of \$3,114.76. These rentals constitute a part of the revenues of the Canal Zone government.

TAXES AND LICENSE FEES.

During the year a total of \$122,674.64 was collected on account of general taxes and licenses, as compared with \$123,876 during the year ended June 30, 1911. There was collected as distillation taxes

\$5,083.71, as compared with \$2,353.88 for the fiscal year ended June 30, 1911, \$3,188.67 during the year 1910, and \$2,209 during the year 1909. Of the total revenues collected on account of distillation taxes, the sum of \$541.91 was received from the issuance of 17 licenses under the Executive order of May 13, 1911, effective September 15, 1911, which provided a tax of 10 cents gold per liter on the liquor distilled. The balance of \$4,542.80 was collected in accordance with the provisions of the Executive order of May 1, 1912, under which seven distillation permits were issued. Forty-eight licenses for the sale of liquor at retail were issued on July 1, 1911. Three of the licensees failed to renew their licenses at the expiration of the first semiannual period and one was revoked in December, 1911, for violation of the liquor regulations. One license was revoked during the second semiannual period. The total collections from this source were \$55,200, as compared with \$68,400 for the previous fiscal year. The sum of \$1,137.83 was collected during the year in license fees from insurance companies doing business in the Canal Zone, as compared with \$512.59 for the preceding fiscal year. Under the provisions of the ordinance providing for the licensing and regulation of motor vehicles in the Canal Zone 72 licenses were issued and the total of \$2,059 was collected in license fees. This amount includes the \$1 paid by each licensee for a metal tag bearing the license number. Six hundred and forty-five bicycle licenses and 97 chauffeur licenses were issued, the revenues from that source being \$645 and \$97, respectively. Under the provisions of section 10 of the order of July 21, 1911, providing for the inspection of steam vessels, there was collected as inspection fees the sum of \$2,837.15.

ADMINISTRATION OF ESTATES.

The collector of revenues, as ex-officio administrator of estates, settled 60 estates of employees of the commission and the Panama Railroad Co., and there were 98 estates in the course of settlement on June 30, 1912. The money handled during the year on account of the administration of estates aggregated \$7,306.31. Nineteen of the estates settled were of deceased American employees and were administered under the provisions of act No. 24 as amended by Executive orders. The total amount involved in the settlement of these 19 estates was \$4,300.90. The remainder of the estates settled, 41 in number, were administered under the provisions of the Executive order of February 5, 1912, effective March 6, 1912, which broadens the collector's jurisdiction in the administration of estates and subjects his settlements to the review and approval of the circuit courts. The last-named order extends the authority of the collector of revenues to the administration of the estates of all employees of the commission or the Panama Railroad Co., when such estates consist of personal property only and do not exceed in value the sum of \$1,000, and also provides for the guardianship of estates of employees of the commission, the government of the Canal Zone, or the Panama Railroad Co., who have been adjudged insane and whose estates, when consisting entirely of personal property, do not exceed \$1,000 each in value. Of the total number of estates settled under this Executive order, 3 were estates of insane persons. The total number of estates of insane persons received for administration under the provisions of this order was 14.

REVENUES.

The revenues collected by the division during the year aggregated \$311,994.81, and the total of all moneys handled was \$5,827,970.10, an increase in the amount of funds handled of \$175,242.82. The said total was made up as follows:

Zone revenues.....	\$311, 994. 81
Money orders issued.....	4, 915, 077. 29
Postal-savings certificates sold.....	600, 898. 00
Total.....	5, 827, 970. 10

DIVISION OF POLICE AND PRISONS.

The organization of the division of police and prisons remains as described in previous reports. On June 30, 1912, the division consisted of a chief, an assistant chief, 2 inspectors, 4 lieutenants, 8 sergeants, 20 corporals, 117 first class white police officers, 116 colored policemen, and 5 clerks. Under my instructions to gradually reduce, as separations occur, the force of colored police officers, during the fiscal year the number was reduced from 116 to 107. Ninety-seven officers were appointed and 106 separated from the service. Three white American officers, Stephen M. Alton, Charles R. Gould, and John D. Kemp, died during the year.

Seven thousand and fifty-five arrests were made during the year, 6,452 of which were males and 603 females, as compared with 5,500 males and 459 females, or a total of 5,959 arrests, for the previous year, and is the largest number of arrests made during any fiscal year since the organization of the division. Of the arrests made, 742 were on felony charges, as against 381 for the previous fiscal year. The increase in arrests over the previous year was largely due to the increase of idle population caused by reductions of force and the replacement of the undesirable with better laborers, leaving the undesirable element out of employment. The increase of arrests has gradually grown as the number of these idle ones increased, in spite of the continued efforts to eliminate arrests for trivial causes. Of the total number of persons arrested, 5,570, or 79 per cent, were convicted.

Nine homicides were committed during the year. Two of the perpetrators committed suicide, and the other 7 were apprehended. Of the 7 apprehended, 3 were convicted of manslaughter and sentenced to terms, 2 for one year and 1 for seven years; 1 was convicted of murder in the second degree and sentenced to 20 years; 1 was dismissed; and the other 2 defendants are now awaiting trial. No capital punishment was administered.

Ten persons committed suicide in the Canal Zone during the year, 4 of whom were Americans.

A police substation was established on Naos Island, effective October 1, 1911, in order to provide the police protection required there on account of the beginning of work on the fortifications and the employment there of a large number of laborers who are also quartered on the island. The police stations at San Pablo, Tabernilla, and Bohio, being within the area to be flooded by the waters of Gatun Lake, were closed on January 13 and 16 and May 12, 1912, respectively. The building formerly used at Tabernilla was moved and

reerected at Gamboa, but up to the present time it has not been found necessary to assign an officer for duty at that point. The building at San Pablo was moved to and reerected at Monte Lirio, on the permanent relocated line of the Panama Railroad, where a station was officially established on February 26, 1912, with a white police officer in charge. The continued growth of the new town of Frijoles, on the permanent line of the Panama Railroad, also made necessary the establishment of a police station at that point, which was opened on March 30, 1912, and a white police officer was placed in charge. On April 24, 1912, the temporary lockup at West Culebra was removed to Margarita Point. At Balboa, owing to the commencement of work upon the permanent terminals, it became necessary to abandon the police station at that point on June 6, 1912. All officers on duty there were transferred to Ancon, and police protection for the town, wharf, and railroad yards is now provided from the Ancon central station. A call-box station has been established in a small building at Balboa for the use of officers assigned to duty there. The abandonment of two substations in the district of Gorgona has resulted in a reduction in the number of police officers assigned for duty in that district. A number of the police officers formerly on duty at the abandoned stations were transferred to other stations which required an increased strength, while others were assigned to patrol duty on the Gatun Lake contour lines. On November 5, 1911, the watchman service performed by two colored police officers at the storehouse of the Panama Railroad commissary at Cristobal was discontinued. In order to provide proper protection for the Gatun locks and dam, the police detachment at Gatun police station, at the request of the division engineer of the Atlantic division, was increased and three white police officers were assigned to watchman service at that point.

A continuous police patrol of the harbors of Ancon and Cristobal has been maintained, and many prosecutions for violations of the navigation laws have resulted. Patrols of the watersheds in the Zone have also been maintained to protect the reservoirs. In addition, the Gatun Lake area has been patrolled, persons living therein have been removed, and shacks and other buildings therein have been destroyed by the Zone police acting under instructions to prevent further settlement.

During the year 522 animals were impounded by the Zone police, and a total of \$926.25 was collected for pound fees and maintenance.

On June 30, 1912, there were 141 convicts confined in the penitentiary at Culebra, as compared with 148 on June 30, 1911; 138 on June 30, 1910; 117 on June 30, 1909; and 108 on June 30, 1908. All convicts have been kept at work on public roads in the Zone, particularly on road construction, except a sufficient detail to perform the necessary work at the penitentiary. During the year 137 convicts were received at the penitentiary, while 144 were discharged. One hundred and fifty-six persons were deported from the Canal Zone, 100 of whom were convicts who had served terms in the penitentiary, and 56 were district prisoners. Six prisoners, 4 of whom were convicts and 2 district prisoners, were pardoned during the year. The sentences of 2 district prisoners and 1 Zone convict were commuted. The value of work performed by the penitentiary convicts, on the basis of 10 cents gold an hour for each convict, was \$28,126.95,

and the cost of guarding, subsisting, and clothing the convicts was \$35,325.03. Included in this amount is \$8,029.42, representing the increased cost of guarding convicts on account of the work performed on public roads. A considerable portion of this sum is represented by the cost of erecting, for the housing of these prisoners, a stockade on the line of the Empire-Chorrera road now under construction.

Five thousand seven hundred and seventy-one writs of process in civil and criminal cases were served during the year, and a total of \$15,481.68 was collected by the acting marshal (chief of police) and his deputies, the whole of which was paid into the treasury of the Canal Zone government. One hundred and seventy deaths were investigated by the chief of police or other members of the force, acting as coroner or deputy coroners. Of these, 53 were due to railroad accidents and 29 to accidental drowning. Police investigation was made of 864 cases of personal injuries, involving 393 commission employees, 160 Panama Railroad employees, and 111 nonemployees.

The canal slides at Culebra made necessary the abandonment of the penitentiary located near the edge of the Culebra cut. All of the convicts confined there, with the exception of a few required to perform inside labor, temporarily held at the police station at West Culebra, were transferred to the Mandingo stockade, where they are employed on the construction of the Empire-Chorrera road, a 16-foot macadam highway extending from Empire westward a distance of about 6 miles to the Zone line, described in the last annual report of the department. The work on this road has gone forward expeditiously and should be completed before December 1, 1912. The same is an excellent piece of road construction—one of the best on the Isthmus. I have recommended the construction of a new penitentiary building on a farm site near Pedro Miguel or the removal of the old penitentiary building from Culebra to the Pedro Miguel site. Final action on this recommendation has been held in abeyance for the present.

A system of target practice with regulation .38 caliber Colt's revolvers was inaugurated in February, 1912. The practice affords opportunity for practical instruction to be given police officers in the use and operation of arms carried and enables such officers to render more efficiently service that may be required of them. Prize medals were awarded for the most skillful target work.

More than a year ago, having reason to believe that men and women were engaged in importing women into the Panaman cities of Panama and Colon for purposes of prostitution, and that, although these operators were as secretive in their plans as it was possible for them to be, they were conveying some of these women—among them girls—through the Canal Zone over the Panama Railroad from one to the other city, and were seeking to procure the entry of some of the women into these cities through Ancon-Balboa Harbor (which, although in the Canal Zone, is the port of entry for the city of Panama), I gave instructions to the Zone police to carefully watch Panama Railroad trains and the ships coming into Zone waters to ascertain if, by means of these trains and ships, women were being conveyed through Canal Zone territory into the two cities named or to other foreign soil for immoral purposes; that is to say, in violation of the act of Congress of June 25, 1910, applicable to United States territory, including the

Canal Zone, and known as the "white-slave" act. As a result proof was secured which, during the fiscal year under the act referred to, led to the arrest and conviction in Zone courts of three persons, two men and one woman, operating independently of each other. The woman received a sentence of one year's imprisonment, which has been served; one of the men received a sentence of one year and nine months' imprisonment, and the other a sentence of one year's imprisonment, which two sentences are now being served. These sentences were for service in the Zone penitentiary and at hard labor. These were the first prosecutions ever instituted in the Canal Zone courts for offenses of this character, and together with the efforts of the police and quarantine officials of the commission, acting under Canal Zone and Panaman authority, in preventing from entry into Isthmian ports white-slave dealers, vicious prostitutes, and other undesirables have had a most salutary effect in minimizing the so-called "white-slave" traffic on the Isthmus.

DIVISION OF FIRE PROTECTION.

The organization of this division consists of 1 chief, 1 assistant chief, 1 clerk, 1 messenger, 7 captains, 7 lieutenants, 40 firemen, 1 engineer, 1 motor engineer, 1 electrician, and 1 linemen. The personnel of the division was increased by the creation of the position of 1 motor engineer at \$150 a month and reduced by 1 fireman at \$125 a month.

The new fire station at Cristobal, which was described in the last annual report, was completed during the year and occupied on January 2, 1912. Owing to the removal of all settlements from the Gatun Lake area and the consequent abandonment of Tabernilla and San Pablo, the paid fireman at Tabernilla was, on December 23, 1911, withdrawn and detailed to Miraflores, where, because of the increase and importance of the work, it became necessary to provide additional fire protection. In order to make room for the construction of the Pacific terminals at Balboa it became necessary to remove the one-man fire station at that point on June 10, 1912, and the fire apparatus and paid fireman will be located in temporary quarters until a permanent fire station at that point is constructed. Alterations was made on the ground floor of Ancon No. 3 (Tivoli) fire station in order to make the building suitable for the new combination automobile fire engine and hose wagon, two of which were recently purchased and are more fully described below. The fire station in the hospital grounds at Ancon was placed in charge of a lieutenant; as soon as the permanent layout at Balboa has been determined, it is proposed to discontinue Ancon Station No. 2 and transfer the apparatus and personnel to the new permanent station to be constructed at Balboa.

Two new combination automobile fire engine and hose wagons were purchased from the Webb Motor Fire Apparatus Co., St. Louis, Mo., during the year at a cost of \$16,000; one for Cristobal and one for Ancon. The engines were received on the Isthmus during April, 1912. On account of the shortage of fresh water in Cristobal and Colon during the latter part of the dry season, both engines were installed at Cristobal fire station. On June 28, 1912, one of the engines (Ancon No. 3) was transferred to Ancon No. 3 fire station,

and the horse-drawn wagon there was transferred to the Culebra station. The new fire engines have added two pumping engines to the equipment of the division without increasing the personnel, and greatly increasing the efficiency at the two stations mentioned.

These automobile fire engines are equipped with bronze rotary fire pumps for pumping salt water, and have carrying capacity for 1,200 feet of 2½-inch rubber-lined fire hose and a complement of 8 men each. The two machines are exactly alike. Each engine is supplied with a 6-cylinder T-head gasoline motor, cast singly, with a rated capacity of 79.3 horse power, A. L. A. M. rating. The machines are equipped with Bosch high-tension magneto, jump spark, and 6-volt storage battery for ignition, and a Mayer carburetor. During the official tests on the Isthmus these machines exceeded the specification requirements in pumping capacity, viz, 600 gallons per minute. The Cristobal engine discharged an average of 664 gallons of water per minute for one hour through two 300-foot lines of hose, fitted with nozzle of 1¼-inch tip, taking suction from the sea at 8-foot lift. The Ancon engine discharged an average of 640 gallons per minute under the same conditions. The machines have a maximum speed of 50 miles per hour.

The volunteer fire companies at Tabernilla, San Pablo, and Balboa were disbanded during the year, the two former because of the abandonment of the towns, and the one at Balboa disbanded on April 1, 1912, because most of the men composing the company reside in the city of Panama and would not be available for duty in case of fire during the night. On June 30, 1912, there were 15 volunteer companies with a total of 251 members.

No new fire-alarm systems were established during the year. All the existing systems, five in number, were inspected, tested, and kept in working order by the electrician of the division. At the close of the year there were in use 45,850 feet of 2½-inch rubber-lined hose, 288 nozzles, 16 hose reels, and 27 hose carts. One thousand four hundred and fifty-four fire extinguishers were under the care of the division on June 30, 1912. Forty thousand one hundred and seventy-seven inspections and 509 recharges of chemical extinguishers were made and 126 extinguishers were repaired. The inspection of buildings and fire-fighting apparatus distributed throughout the Zone and in buildings of the United States and the Panama Railroad Co. in the cities of Panama and Colon and on Naos, Culebra, and Taboga Islands, at the Palo Seco Leper Asylum, and at Porto Bello and Nombre de Dios was maintained.

Three hundred and thirty-three alarms of fire were responded to during the year, 18 of which were false alarms. Of the 315 actual fires, 6 were in the city of Panama and 2 in the city of Colon; 196 fires were in Government property and 21 in property of the Panama Railroad Co. The value of Government and railroad property involved, including the buildings and their contents, was \$1,755,685.58, and the total loss is estimated at \$4,538.58 in Government property and \$101 in property of the Panama Railroad Co. The average loss in all fires in Government and Panama Railroad property was \$21.38 per fire. The loss in the three larger fires in the Canal Zone was \$8,897.50, while the value of property involved was estimated at \$11,897.50.

The largest fire during the year and to which Ancon companies Nos. 2 and 3 responded on February 23, 1912, was in the city of Panama in a three-story stone and wood building, resulting in a property loss estimated by the owners at \$21,120, the value of the property involved being \$254,000. The largest fire on the Zone during the year totally destroyed two private frame buildings, with their contents, at Miraflores on August 27, 1911. The value of the buildings was estimated at \$4,000 and the contents at \$1,000. Another fire, causing a damage to the extent of \$2,000, occurred on the Las Cascadas cocoa and rubber plantation near Empire on March 16, 1912. A fire at Pedro Miguel on April 6, 1912, resulted in the complete loss of steam shovel No. 107. The fire started in the crib-work of railroad ties supporting the steam shovel, which was working in the canal outside of the hydrant district. The loss is estimated at \$1,897.50. A fire in a gasoline launch near Dock No. 11 at Cristobal on June 29, 1912, caused by an overheated exhaust pipe, caused a loss to the commission of \$700. A fire at Colon on October 24, 1911, destroyed the upper part of the two-story frame building on Hudson Lane near Eighth Street, causing a loss estimated at \$5,000, the value of the building being reported at \$10,000. There were 8 fires in which the loss amounted to from \$100 to \$300.

The value of private property involved in the 34 fires reported is estimated at \$31,310 and the loss at \$8,014.

Two persons died as a result of burns received from explosions. One of these was an employee of the commission, who, while engaged in cleaning off the sides and trusses in one of the compartments of U. S. barge *No. 10* at Cristobal dry dock on February 9, 1912, was killed in an explosion of gasoline fumes, and the other was a colored woman, who died at Colon Hospital on the day following an explosion of alcohol while attempting to light a fire in a cookstove at Gatun on July 22, 1911. There were also 12 persons who received burns more or less serious, but which did not prove fatal. Seven of these were employees who were at work on barge *No. 10*, above referred to; 1 person was burned by an explosion of alcohol; 1 by an explosion of gasoline; 2 by accidental ignition of gasoline and oil; and 1 person received burns in attempting to extinguish an alcohol fire.

Satisfactory relations were maintained with the fire departments of the cities of Panama and Colon. During the year extensions of water mains, installations of fire hydrants, and extensions of roads were made which resulted in the increased efficiency of this division.

DIVISION OF PUBLIC WORKS.

The work of this division remains as described in the previous reports. The organization of the division consists of 1 superintendent, 1 assistant superintendent, 6 clerks, 1 inspector and messenger, 2 inspectors of plumbing, 1 inspector of meters, 1 market inspector, 3 engineers, 6 foremen, 13 masons, 19 pipe fitters, 20 laborers, and 1 carpenter. As the various public improvements in the cities of Panama and Colon under the \$800,000 appropriation were being completed and the completed sections turned over to the division of public works for maintenance, it became necessary to increase the silver hourly force engaged on maintenance work. The increase in the number of silver laborers thus employed on June 30, 1912, over June 30, 1911, was 10.

In the city of Panama there were on June 30, 1912, 1,985 water connections and 35 applications pending, an increase of 169 connections during the year. The installation of all plumbing resulting from these new connections, as well as repairs and extensions of existing plumbing, was inspected by the employees of the division.

The collections of water rents from private consumers for the first three-quarters of the year in the city of Panama were \$67,491.75, and the net amount of the bills rendered for the quarter ended June 30, 1912, was \$25,436.25, a total for the year of \$92,928. A deficiency of \$831.65 for the quarter ended September 30, 1911, was paid by the Panama Government. For the quarters ended December 31, 1911, and March 31, 1912, the amount of water collections in said city exceeded the amortization fund requirements under the contract between the United States Government and the Government of the Republic of Panama dated September 30, 1910, resulting in a surplus of \$4,293.26, which was applied to the reduction of the capital cost of the water works, sewers, and pavements. For the fiscal year ended June 30, 1912, the total water consumed in the city of Panama was 511,763,973 gallons, and the average daily consumption of water per capita, based upon the recent census of the city of Panama, was 39.52 gallons. The average annual charge per connection was \$51.33.

The water mains, hydrants, valves, taps, etc., were kept in order during the year. Meters were tested, repaired and set as needed, and sewers, manholes, and catch basins were kept clean and in working order.

In the city of Colon on June 30, 1912, there were 731 connections using water and 45 applications for connections pending, making a total of 776, or an increase during the year of 153. The water collections in Colon from private consumers for the first three-quarters of the year were \$46,823.50, and the amount paid by the Panama Railroad Co. and the Isthmian Canal Commission during the same period was \$11,807.70; the net amount of water bills rendered against private consumers for the quarter ended June 30, 1912, was \$16,836, and the bills against the Isthmian Canal Commission and the Panama Railroad Co. for the same period amounted to \$3,787.80, making a total for the year of \$79,255. For the city of Colon the Republic of Panama was required to pay \$10,943.11 for the first three-quarters of the fiscal year in order to liquidate the proportion of the part of the capital cost of the water, sewer, and street systems due, together with interest and expense of operation and maintenance. The average daily consumption of water in Colon was 1,113,659 gallons, and the daily per capita consumption, based upon a population of 17,748, as shown by the recent Panama census, was 62.52 gallons. The average annual charge per private connection was \$104.06. During the year 149 water and sewer connections were made by the division for private property owners in the cities of Panama and Colon at a cost of \$2,824.92, which amount was paid in advance when applications were made for the connections.

In the Canal Zone on June 30, 1912, there were 691 water connections in use and 26 applications pending, making a total of 717 connections, an increase for the year of 102. All of the plumbing installations resulting from these connections, as well as the repairs and extensions to existing plumbing, were inspected by employees of the division. Zone water bills to a net amount of \$29,120.78 were pre-

pared and forwarded to the collector of revenues for collection, as compared with \$19,362.25 during the previous fiscal year. The average charge per connection was \$44.12.

Eight public markets under the direction of this division were in operation, and a revenue of \$4,183.95 was derived from the rental of space therein, as compared with \$4,786.67 for the preceding fiscal year. The decrease of \$602.72 from the net revenues from this source from the previous fiscal year is largely due to the closing of the Tabernilla market early in the year because of the abandonment of the town. At the two public slaughterhouses of the Zone, one at Empire and the other at Gorgona, 2,508 cattle, 371 hogs, and 8 goats were slaughtered, a decrease in the total number of animals slaughtered during the preceding fiscal year of 4,625.

An inspection was made during the year of all Zone roads and trails, and 63 miles of trails were cleared under private contract of all trees and brush. Five miles of trails were cleared in the central district by poll-tax labor. A steam road roller was purchased for the division for street repair work in the city of Colon. Eight thousand feet of macadam streets were resurfaced in the city of Colon, and 1,000 square yards of brick paving replaced on Front Street. In the city of Panama the road from Calidonia Bridge, near the Panama Railroad station to the Zone boundary, a distance of over 1 mile, was completely resurfaced. Ten thousand square yards of macadam in the city of Panama were resurfaced. The substantial repair and resurfacing of the entire Las Sabanas highway in the Zone at a probable cost of \$9,000, Canal Zone funds, was begun in April, 1912, and is yet under way. Reference to the construction of the Empire-Chorrera road is made under the head of the division of police and prisons.

DIVISION OF SCHOOLS.

The organization of this division consists of 1 superintendent, 2 clerks, 1 supervisor of primary grades, 2 supervisors of children, 1 principal of high school, 7 principals of grammar schools, 66 teachers, and 1 gardener temporarily employed.

The schools for the year 1911-12 opened on October 1, 1911, with an enrollment in that month of 2,105 children, 1,174 in the white and 931 in the colored schools as compared with 931 white and 906 in the colored schools on October 1, 1910. The highest monthly enrollment was in June, 1912, when 1,556 pupils were enrolled in the white schools and 1,765 in the colored schools. An exceptionally efficient corps of teachers was maintained. Of the 48 white teachers of the division, 13 hold degrees from colleges or universities, 19 hold diplomas from standard normal schools, 12 have had two or more years' normal, college, or university training, 25 have had six or more years' experience, 19 have had three or more years', and 4 two or more years' experience in public-school work. Excellent work was done in all the schools, and there were five graduates in the Canal Zone High School.

October, 1911, the upper grade white school at Paraiso was consolidated with the Pedro Miguel white school and the children transported to and from Pedro Miguel by break. A new school for white children between the first and fifth grades was opened at Las Cascadas

on October 2. Another school for white children of all grades was established at Porto Bello on November 6. New schools for colored children were also established at Majagual, Miraflores, and Cucaracha on October 2 and at Mandingo and Ancon on October 16 and November 17, respectively. The Cristobal colored school was reopened on October 2 in the new school building constructed to replace the one destroyed by fire on March 23, 1911.

On June 30, 1912, there were 26 buildings used for school purposes, 11 for white schools and 15 for colored schools. One of these, a school for lower grade white children, was conducted in a room of the Las Cascadas Hotel building, and another in a room in house No. 52, Porto Bello, while the school for native children at Majagual was maintained in the native church building at that point. New buildings were erected or old buildings converted for school purposes as follows: Mandingo, 1 room; Ancon, 4 rooms; Miraflores, 1 room; and Cucaracha, 1 room; all for colored children; while the school building at Tabernilla for white children was reerected at Mount Hope for colored children. An addition of one room was made to the school building at Pedro Miguel for white children.

A school garden was maintained in connection with the colored school at Empire, from which the estimated income from the sale of school-garden products was \$218.64, as compared with \$783.53 during the school year 1910-11, and \$332.72 during the school year 1909-10.

During the year the sum of \$694 was collected for tuition, as compared with \$576 collected during the previous year. The system of medical inspection of the pupils, inaugurated in the month of January of last year, has been continued. During the school year 1,020 pupils were examined or treated.

CANAL ZONE TREASURY AND ZONE FUNDS.

The office of the treasurer of the Canal Zone consists of a treasurer, an assistant treasurer, and 2 clerks.

At the beginning of the fiscal year there was a balance of \$197,207.56 on hand in the Zone treasury, and during the year there was collected the total of \$370,272.81, of which the sum of \$110,513.13 was postal receipts.

The expenditures amounted to \$312,459.75. The estimated revenues of the Canal Zone during the current fiscal year (1913) are \$220,000, exclusive of postal receipts, and will be expended, approximately, as follows:

Maintenance of schools.....	\$90,000
Expenses of district courts.....	20,000
Maintenance of pauper sick in Isthmian Canal Commission hospitals.....	2,400
Maintenance of misdemeanor prisoners.....	15,000
Maintenance of markets and slaughterhouses.....	4,000
Construction, repair, maintenance, and operation of roads, trails, bridges, waterworks and sewers, and other miscellaneous public works and improvements.....	78,600
Miscellaneous and contingent expenses.....	10,000
Total.....	220,000

The postal revenues during the current year will, it is estimated, amount, approximately, to \$94,000 and they will be applied to the maintenance of the postal service.

COURTS.

The supreme court held 12 sessions during the year. It affirmed the decision of the circuit court in 4 criminal cases and reversed the decision of that court in 1 criminal case. Four civil cases were pending in the court at the beginning of the year, 6 were filed, and 8 were disposed of.

In the circuit courts 567 criminal cases were instituted. The defendants were convicted in 353 cases and 126 were acquitted, 84 cases were dismissed, and 23 cases were pending on June 30. There were 541 civil cases filed during the year; 414 were disposed of and 127 were pending at the close of the year.

In the district courts, 7,128 criminal cases were instituted. The defendants were convicted in 5,183 cases and acquitted in 1,063 cases, 350 cases were dismissed, 528 cases were appealed to the circuit courts, and 4 cases were yet pending in the district courts on June 30. Thirteen hundred and five civil cases were filed during the year, 1,280 were disposed of, and 25 cases were pending at the close of the year.

The organization of the judiciary consists of 1 chief justice, 2 associate justices, 4 district judges, 8 clerks, 2 translators, and 2 messengers.

On September 29, 1911, William H. Jackson, late senior district judge, was, by the Executive order of the President dated September 21, 1911, appointed associate justice of the supreme court, and was assigned to the second judicial circuit. The district judgeship vacated by Judge Jackson upon his appointment as associate justice remained unfilled, and was abolished on July 1, 1912, and the present organization provides for 4 district judges instead of 5, as was provided for in the former organization.

INCREASE OF WORK OF THE DEPARTMENT.

Notwithstanding the fact that we are nearing the completion of the canal, the work in practically every division of the department of civil administration and in the courts increased, instead of having diminished, during the recent fiscal year. This may be easily noted by a comparison of this report with the reports for the department for former years. Notwithstanding this increase, we have, by careful management and economies of service, been able to perform this increased work without an increase in our organization; in fact, we have made some reductions in our organization.

FUTURE ORGANIZATION.

Whatever action Congress may take on the question of permanent government of the Zone, there will have to be permanently maintained here, in addition to the civil courts, divisions, officers, and employees performing civil functions or functions which are civil in their nature, such as policing the Zone; furnishing fire protection; conducting the schools; maintaining and extending public works in the Zone and (under treaty provisions) in the cities of Panama and Colon; inspection of steam and other vessels entering Zone waters; handling postal, customs, and revenue affairs; and related matters. Whenever, because of the reduction of the commission force incident

to the approaching completion of the canal, a material reduction of the civil administration force is required, its organization is such as to permit such reduction to be readily made.

APPENDICES.

Attention is called to the statements attached as appendices to this report, which indicate in detail the business transacted throughout the department. There are also attached appendices showing the organization of the various divisions making up the department of civil administration.

Very respectfully,

M. H. THATCHER,

Head of Department of Civil Administration.

Col. GEORGE W. GOETHALS, United States Army,

Chairman Isthmian Canal Commission, Culebra, Canal Zone.

APPENDICES TO REPORT OF THE HEAD OF THE DEPARTMENT OF CIVIL ADMINISTRATION.

APPENDIX I.

- TABLE 1. Sale of postage stamps and collections on account of second-class mail matter, by months, during the fiscal year ended June 30, 1912.
- TABLE 2. Letters and parcels registered, by offices, during the fiscal year ended June 30, 1912.
- TABLE 3. Number of dispatches of mail from the exchange office at Cristobal and number of pouches, sacks, and registered sacks handled by railway mail messengers during the fiscal year ended June 30, 1912.
- TABLE 4. Destination of dispatches of mail by the exchange office at Cristobal during the fiscal year ended June 30, 1912.
- TABLE 5. Money orders issued, by months, during the fiscal year ended June 30, 1912.
- TABLE 6. Money orders paid and repaid during fiscal year ended June 30, 1912.
- TABLE 7. Amount of money orders, by offices, payable to the remitter and drawn on the issuing office, remaining unpaid on June 30, 1912.
- TABLE 8. Customs operations at the port of Ancon during the fiscal year ended June 30, 1912.
- TABLE 9. Customs operations at the port of Cristobal during the fiscal year ended June 30, 1912.
- TABLE 10. Statement of distillation taxes collected during the fiscal year ended June 30, 1912.
- TABLE 11. Statement of collections on account of saloon licenses during the fiscal year ended June 30, 1912.
- TABLE 12. Statement of land and building rents collected during the fiscal year ended June 30, 1912.
- TABLE 13. Statement, by months, of estates of deceased American employees administered by the administrator of estates during the fiscal year ended June 30, 1912.
- TABLE 14. Statement of number and amount of postal savings accounts opened at each post office during the period February 1, 1912, to June 30, 1912, together with number and amount on hand June 30, 1912.
- TABLE 15. Statement of number and nationalities of postal savings depositors having open accounts in Canal Zone post offices on June 30, 1912.

APPENDIX II.

- TABLE 16. Authorized strength of division of police and prisons June 30, 1912.
- TABLE 17. Actual strength of division of police and prisons on June 30, 1904-1912.
- TABLE 18. Actual strength of stations and substations on June 30, 1912.
- TABLE 19. Number of arrests, by fiscal years, made in the Canal Zone since the organization of the division of police and prisons.
- TABLE 20. Number of arrests, by months, made during the fiscal year ended June 30, 1912.

- TABLE 21. Statement of convictions of persons arrested during the fiscal year ended June 30, 1912.
- TABLE 22. Charges against persons arrested during the fiscal year ended June 30, 1912.
- TABLE 23. Nationality of persons arrested during the fiscal year ended June 30, 1912.
- TABLE 24. Statement of arrests, by stations, during the fiscal year ended June 30, 1912.
- TABLE 25. Occupations of persons arrested during the fiscal year ended June 30, 1912.
- TABLE 26. Crimes committed by prisoners confined in the penitentiary June 30, 1912.
- TABLE 27. Occupations of prisoners confined in the penitentiary June 30, 1912.
- TABLE 28. Nationality of persons confined in the penitentiary June 30, 1912.
- TABLE 29. Ages of prisoners confined in the penitentiary June 30, 1912.
- TABLE 30. Causes of deaths investigated by the coroner during the fiscal year ended June 30, 1912.
- TABLE 31. Nationality of persons whose deaths were investigated by the coroner during the fiscal year ended June 30, 1912.
- TABLE 32. Statement of accidents involving personal injuries investigated during the fiscal year ended June 30, 1912.

APPENDIX III.

- TABLE 33. Consumption of water, collections made, and bills outstanding for water rents in the city of Panama for the fiscal year ended June 30, 1912.
- TABLE 34. Consumption of water, collections made, and bills outstanding for water rents in the city of Colon, for the fiscal year ended June 30, 1912.

APPENDIX IV.

- TABLE 35. Monthly enrollment and average daily attendance in white and colored schools during the fiscal year ended June 30, 1912.
- TABLE 36. Total enrollment, by schools, during the fiscal year ended June 30, 1912.
- TABLE 37. Enrollment, by grades, during the fiscal year ended June 30, 1912.
- TABLE 38. Number of teachers employed in white and colored schools and number of days of sickness of teachers during the fiscal year ended June 30, 1912.
- TABLE 39. Statement of the value of products raised in school gardens.

APPENDIX V.

- TABLE 40. Revenues collected from July 1, 1911, to June 30, 1912.
- TABLE 41. Expenditures from July 1, 1911, to June 30, 1912.
- TABLE 42. Statement of balances in the Canal Zone treasury on June 30, 1912.

APPENDIX VI.

- TABLE 43. Business transacted in the supreme court of the Canal Zone.
- TABLE 44. Business transacted in the first circuit court.
- TABLE 45. Business transacted in the second circuit court.
- TABLE 46. Business transacted in the third circuit court.
- TABLE 47. Business transacted in the district court of the district of Ancon.
- TABLE 48. Business transacted in the district court of the district of Empire.
- TABLE 49. Business transacted in the district court of the district of Gorgona.
- TABLE 50. Business transacted in the district court of the district of Cristobal.

APPENDIX VII.—*Legislation.*

(For Executive orders see Appendix T.)

ORDINANCES.

1. Ordinance enacted by the Isthmian Canal Commission, August 5, 1911, and approved by the Secretary of War, August 22, 1911, amending section 7 of the ordinance providing for certain taxes and licenses in the Canal Zone.
2. Ordinance enacted by the Isthmian Canal Commission, August 5, 1911, and approved by the Secretary of War, August 22, 1911, providing for night quarantine inspection of vessels at the port of Colon.
3. Ordinance enacted by the Isthmian Canal Commission, August 5, 1911, and approved by the Secretary of War, August 22, 1911, establishing market regulations for Canal Zone.
4. Ordinance enacted by the Isthmian Canal Commission, August 5, 1911, and approved by the Secretary of War, August 22, 1911, providing for the impounding of stray animals.

5. Ordinance enacted by the Isthmian Canal Commission, April 9, 1912, and approved by the Secretary of War, May 1, 1912, amending section 1 of the ordinance enacted by the commission on August 25, 1910, providing for the licensing and regulation of motor vehicles in the Canal Zone.

APPENDIX VIII.

TABLE 51. Licenses issued by the board of local inspectors during the fiscal year ended June 30, 1912.

TABLE 52. Statement of receipts from steamboat-inspection service, December 1, 1911, to June 30, 1912.

APPENDIX IX.

TABLE 53. Statement of fires during the fiscal year ended June 30, 1912.

APPENDIX X.

TABLE 54. Population of the Canal Zone classified by towns according to the census of February 1, 1912.

TABLE 55. Total population distributed by country of which citizen or subject, and sex.

APPENDIX I.—DIVISION OF POSTS, CUSTOMS AND REVENUES.

TABLE 1.—*Sale of postage stamps and collections on account of second-class mail matter, by months, during the fiscal year ended June 30, 1912.*

Month.	First class.	Second class.	Month.	First class.	Second class.
1911.			1912.		
July.....	\$6,010.79	\$0.20	January.....	\$7,202.91	\$14.93
August.....	5,977.00	1.60	February.....	7,826.21	13.41
September.....	7,339.00	2.23	March.....	8,596.00	16.38
October.....	6,501.00	16.10	April.....	6,930.00	12.38
November.....	6,862.00	18.26	May.....	6,436.50	13.92
December.....	10,494.80	20.04	June.....	7,374.00	14.79
			Total.....	87,550.21	144.24

TABLE 2.—*Letters and parcels registered, by offices, during the fiscal year ended June 30, 1912.*

Name of post office.	Domestic letters registered.	Domestic parcels registered.	Foreign letters registered.	Foreign parcels registered.	Official registered free.	Distribution registered free.	Total.
Ancon.....	3,172	1,287	5,034	519	16,810	42	26,864
Balboa.....	1,098	208	1,490	41	1,866	75	4,778
Bas Obispo.....	364	54	424		1,073	61	1,976
*Bohio.....	17	5	101	5	56	1	185
Corozal.....	636	164	642	14	2,808	74	4,338
Cristobal.....	5,355	1,164	11,035	227	6,862	563	25,206
Station A.....	319	47	389	10	586	50	1,401
Station B.....	156	28	415	14	905	27	1,545
Culebra.....	1,495	339	3,201	54	5,826	15	10,930
Empire.....	2,866	1,206	6,967	427	17,376	232	29,074
Gatun.....	2,855	733	6,513	138	4,279	200	14,718
Gorgona.....	1,403	365	1,612	69	2,785	136	6,370
Las Cascadas.....	1,061	458	1,359	50	2,362	157	5,447
Matachin.....	120	20	190	31	505	19	885
Miraflores.....	295	46	1,404	13	1,035	47	2,840
Monte Lirio.....	2		1		7		10
Paraiso.....	412	166	1,149	23	1,144	48	2,942
Pedro Miguel.....	758	229	1,787	67	2,197	131	5,169
*San Pablo.....	39	4	56	1	105	11	216
*Tabernilla.....	52	26	52		557	48	735
Total.....	22,477	6,549	43,823	1,703	69,144	1,937	145,633

Post offices marked (*) were discontinued at close of business Feb. 13, 1912.

TABLE 3.—*Number of dispatches of mail from the exchange office at Cristobal, and number of pouches, sacks, and registered sacks handled by railway mail messengers during the fiscal year ended June 30, 1912.*

Month.	Pouches.	Sacks.	Registered sacks.	Total.	Dispatches.
1911.					
July.....	3,511	1,170	354	5,035	90
August.....	3,759	754	164	4,677	109
September.....	3,753	1,175	188	6,116	97
October.....	4,061	1,157	172	5,390	102
November.....	3,641	1,197	370	5,208	95
December.....	4,422	1,123	200	5,745	92
1912.					
January.....	3,614	1,225	367	5,206	110
February.....	3,671	1,258	373	5,302	109
March.....	3,597	1,181	371	5,149	102
April.....	3,624	1,242	362	5,228	108
May.....	3,811	1,273	372	5,456	114
June.....	3,674	1,530	383	5,587	107
Total.....	45,138	14,285	3,676	64,099	1,235

TABLE 4.—*Destination of dispatches of mail by the exchange office at Cristobal during the fiscal year ended June 30, 1912.*

Destination.	Number of dispatches.	Destination.	Number of dispatches.
New York, by Panama R. R., U. F., Royal Mail, and Hamburg-American steamers.....	89	Dominica.....	5
New Orleans, La. (States mail).....	50	Grenada.....	27
Jamaica.....	127	Montserrat.....	12
Barbados and distribution.....	28	Nevis.....	5
Trinidad and distribution.....	38	St. Kitts.....	8
French lines Colon-Bordeaux, Colon-St. Nazaire.....	24	St. Lucia.....	24
Martinique via French line.....	24	St. Vincent.....	27
Antigua.....	26	Colombia.....	25
British Guiana.....	27	Port Limon, Costa Rica.....	69
		Colon.....	600
		Total.....	1,235

TABLE 5.—*Money orders issued, by months, during fiscal year ended June 30, 1912.*

Month.	Orders issued.	On the United States. ¹	On the Canal Zone.	On Martinique.	On Costa Rica.	Amount.	Fees.
1911.							
July.....	16,669	\$305,895.68	\$100,969.73	\$372.50	\$160.00	\$407,397.91	\$1,811.04
August.....	17,239	319,212.76	100,110.13	611.00	260.00	420,193.89	1,859.22
September.....	19,408	340,976.06	109,328.56	779.50	131.90	451,216.02	2,039.30
October.....	18,086	305,827.83	110,781.39	907.61	60.00	417,576.83	1,893.08
November.....	23,256	370,540.80	115,603.22	636.55	310.00	487,090.57	2,303.21
December.....	21,269	328,981.20	97,800.32	600.71	101.25	427,483.48	2,051.27
1912.							
January.....	18,483	302,635.93	101,404.02	691.75	160.00	404,891.70	1,873.79
February.....	20,455	346,660.26	70,527.49	1,048.90	183.00	418,419.65	1,991.56
March.....	18,447	311,604.49	63,173.94	568.25	259.00	375,605.68	1,790.31
April.....	17,940	292,427.19	70,412.07	643.88	234.40	363,717.54	1,739.76
May.....	19,282	319,392.40	75,159.59	1,099.60	234.00	395,885.59	1,879.40
June.....	17,146	279,362.95	65,555.28	644.70	35.50	345,598.43	1,657.96
Total.....	227,680	3,823,517.55	1,080,825.74	8,604.95	2,129.05	4,915,077.29	22,889.90

¹ Includes orders drawn on foreign countries, except Martinique and Costa Rica.
Average value of orders, \$21.54.

TABLE 6.—*Money orders paid and repaid during fiscal year ended June 30, 1912.*

Month.	Amount.	Month.	Amount.
1911.		1912.	
July.....	\$120,906.35	January.....	\$91,134.53
August.....	114,685.16	February.....	149,252.57
September.....	131,009.41	March.....	104,676.01
October.....	91,942.85	April.....	104,963.46
November.....	128,493.32	May.....	116,984.32
December.....	113,392.71	June.....	86,638.99
		Total.....	1,354,079.68

TABLE 7.—*Amount of money orders, by offices, payable to the remitter and drawn on issuing office, remaining unpaid on June 30, 1912.*

Office.	Amount.	Office.	Amount.
Ancon.....	\$6,414.00	Gatun.....	\$47,031.25
Balboa.....	6,125.00	Gorgona.....	20,096.00
Bas Obispo.....	9,182.80	Las Cascadas.....	7,795.75
Corozal.....	15,895.30	Matachin.....	3,265.60
Cristobal.....	12,511.40	Miraflores.....	9,568.00
Cristobal, Station A.....	2,977.50	Paraíso.....	14,399.00
Cristobal, Station B.....	1,663.00	Pedro Miguel.....	19,020.95
Culebra.....	10,383.70	Total.....	193,817.40
Empire.....	7,488.25		

TABLE 8.—*Customs operations at the port of Ancon during the fiscal year ended June 30, 1912.*

Nationality.	Class.	Entering.		Clearing.	
		Number.	Tonnage.	Number.	Tonnage.
American.....	Steam.....	121	237,620	122	239,306
Do.....	Sail.....	5	8,608	6	10,060
British.....	Steam.....	124	205,707	121	202,739
Peruvian.....	do.....	45	101,298	46	103,729
Do.....	Sail.....	1	403	1	403
Chilean.....	Steam.....	26	51,049	26	51,049
Norwegian.....	do.....	5	14,737	5	14,737
Total.....		327	619,422	327	622,023

Number of vessels in port from last year.....	7
Tonnage in port from last year.....	13,126
Number of vessels remaining in port.....	7
Tonnage remaining in port.....	10,525
Services to American seamen:	
Seamen shipped.....	739
Seamen discharged.....	607
Seamen deserted.....	119
Seamen deceased.....	2
Movement of passengers and cargo:	
Tons of cargo arriving, in transit.....	301,459
Tons of cargo arriving, local.....	43,521
Number of barrels of oil arriving, local.....	1,025,002
Tons of cargo departing, in transit.....	384,161
Tons of cargo departing, local.....	330
Passengers arriving—	
Cabin.....	4,227
Steerage.....	1,926
Total.....	6,253
Passengers departing—	
Cabin.....	4,062
Steerage.....	2,016
Total.....	6,078
Services to Chinese, Syrians, and Turks:	
Chinese arriving.....	124
Chinese transferred to other ships.....	7
Chinese returned to port of embarkation.....	1
Chinese escaped.....	0
Syrians arriving, in transit.....	44
Turks arriving, in transit.....	4

TABLE 9.—*Customs operations at the port of Cristobal during the fiscal year ended June 30, 1912.*

Nationality.	Class.	Entering.		Clearing.	
		Number.	Tonnage.	Number.	Tonnage.
American.....	Steam.....	100	372,300	99	366,105
Do.....	Sail.....	1	790	1	790
British.....	do.....	1	27	1	27
Do.....	Steam.....	90	219,054	90	219,539
Norwegian.....	do.....	79	178,008	78	175,006
Danish.....	do.....	4	8,651	4	8,651
German.....	do.....	3	5,074	3	5,074
Colombian.....	do.....	1	29	1	29
Panaman.....	Sail.....	5	223	5	223
Total.....		284	784,156	282	775,444

Number of vessels in port from last year.....	5
Tonnage in port from last year.....	12,632
Number of vessels remaining in port.....	7
Tonnage remaining in port.....	21,344
Services to American seamen:	
Seamen shipped.....	104
Seamen discharged.....	72
Seamen deserted.....	31
Seamen deceased.....	1
Movement of passengers and cargo:	
Tons of cargo arriving, in transit.....	159,479
Tons of cargo arriving, local.....	1,025,256
Tons of cargo departing, in transit.....	199,799
Tons of cargo departing, local.....	18,346
Passengers arriving:	
Cabin.....	5,759
Steerage.....	839
Total.....	6,598
Passengers departing:	
Cabin.....	5,384
Steerage.....	1,053
Total.....	6,437

TABLE 10.—*Distillation taxes collected during the fiscal year ended June 30, 1912.*

Month.	Number.	Amount.
1911.		
Licenses:		
July.....	13	\$475.21
August.....	4	65.70
Total.....	17	540.91
Liters distilled:		
September.....		
October.....		
November.....	108	10.80
December.....	2,788	278.80
1912.		
January.....		
February.....	72	7.20
March.....	421	42.10
April.....	10,093	1,009.30
May.....	14,026	1,402.60
June.....	17,920	1,792.00
Liters distilled.....	45,428	4,542.80
Licenses issued.....	17	540.91
Total.....		5,083.71

NOTE.—Under the Executive order of June 13, 1911, effective Sept. 13, 1911, distillation taxes were collected at the rate of 10 cents gold per liter measurement on amount of liquor distilled.

TABLE 11.—*Collections on account of saloon licenses during fiscal year ended June 30, 1912.*

	July 1, 1911.		Jan. 1, 1912.	
	Licenses.	Amount.	Licenses.	Amount.
Cristobal.....	10	\$6,000.00	8	\$4,800.00
Empire.....	28	16,800.00	27	16,200.00
Gorgona.....	10	6,000.00	9	5,400.00
Total.....	48	28,800.00	44	26,400.00

Total amount, \$55,200.

TABLE 12.—*Land and building rents collected during the fiscal year ended June 30, 1912.*

Month.	Lands.	Build-ings.	Total.	Month.	Lands.	Build-ings.	Total.
1911.				1912.			
July.....	\$663.05	\$281.80	\$944.85	January.....	\$1,148.77	\$623.00	\$1,771.77
August.....	773.54	690.00	1,463.54	February.....	929.18	532.15	1,461.33
September.....	847.70	379.00	1,226.70	March.....	418.54	923.00	1,346.54
October.....	651.53	401.33	1,052.86	April.....	489.24	869.50	1,358.74
November.....	1,077.05	563.33	1,640.38	May.....	256.58	743.50	1,000.08
December.....	890.52	734.34	1,624.86	June.....	395.31	744.33	1,139.64
				Total.....	8,541.01	7,490.28	16,031.29

TABLE 13.—*Statement, by months, of estates of deceased American employees administered by the administrator of estates during the fiscal year ended June 30, 1912.*

	Number received.	Number settled.	Amount of funds collected.
On hand and unsettled July 1, 1911.....	8		
1911.			
August.....	5	3	\$1,064.85
September.....	2	1	591.20
October.....	1	1	79.72
November.....	2	3	1,010.74
December.....	4	5	1,053.99
1912.			
January.....	5	2	694.43
February.....	1	4	365.45
Total under act No. 24.....	28	19	4,860.38
On hand and unsettled Mar. 1, 1912.....	9		
March.....	14	1	814.19
April.....	49	1	2,221.31
May.....	30	11	1,673.49
June.....	37	28	2,019.19
Total under Executive order of Feb. 5, 1912.....	130	41	6,728.18
Total for year.....	158	60	11,588.56

Number of estates remaining unsettled June 30, 1912, 98.

TABLE 14.—*Number and amount of postal-savings accounts opened at each post office during the period Feb. 1, 1912, to June 30, 1912, together with number and amount on hand June 30, 1912.*

Office.	Total number of accounts opened.	Number remaining open on June 30, 1912.	Value of certificates issued.	Value of certificates paid.	Balance on deposit.
Ancon.....	275	190	\$31,171.00	\$14,131.00	\$17,520.00
Balboa.....	352	209	46,646.00	19,731.00	27,295.00
Bas Obispo.....	15	10	3,425.00	575.00	1,775.00
Corozal.....	194	155	46,379.00	19,030.00	29,544.00
Cristobal.....	185	126	41,274.00	16,944.00	25,230.00
Station A.....	17	10	3,278.00	887.00	2,241.00
Station B.....	33	22	3,980.00	1,326.00	2,514.00
Culebra.....	367	265	52,642.00	23,872.00	27,275.00
Empire.....	223	143	40,209.00	9,327.00	30,942.00
Gatun.....	246	171	54,835.00	21,221.00	33,119.00
Gorgona.....	429	298	100,967.00	44,156.00	56,254.00
Las Cascadas.....	269	157	47,948.00	23,548.00	24,430.00
Matachin.....	49	36	3,446.00	1,028.00	2,418.00
Miraflores.....	231	172	23,514.00	6,881.00	16,753.00
Paraiso.....	113	76	20,816.00	9,276.00	11,600.00
Pedro Miguel.....	521	362	80,368.00	32,018.00	47,977.00
Total.....	3,518	2,402	600,898.00	243,951.00	356,947.00

TABLE 15.—*Number and nationalities of postal-savings depositors having open accounts in Canal Zone post offices on June 30, 1912.*

Nationality.	Ancon.	Balboa.	Bas Obispo.	Corozal.	Culebra.	Cristobal.	Cristobal, Station A.	Cristobal, Station B.	Empire.	Gatun.	Gorgona.	Las Cascadas.	Matachin.	Miraflores.	Paraiso.	Pedro Miguel.	Total.
Austria.....	1		1		1			1								1	5
Canada.....		3			2												5
Chile.....		1															1
China.....																1	1
Colombia.....		1												3		1	5
Denmark.....										1							1
Ecuador.....														3			3
England.....		3	1		1			1		11							17
Finland.....				1						1							2
France.....		2												4			6
Germany.....		5		1	1					1						3	11
Greece.....				2	3				3			5				6	19
Guadeloupe.....														2			2
Honduras.....		1								1							1
Hungary.....							1			1							2
India.....	1	2			1				1								5
Ireland.....		1															1
Italy.....	1	13		2	6	1			1		1			31	1	12	69
Mexico.....					1											1	2
Panama.....					1	1											2
Peru.....		1														2	3
Porto Rico.....																1	1
Portugal.....		1			1									2		2	6
Russia.....		2			1					1						1	5
Spain.....	2	29		2	47				4	2	1	34		54	2	50	227
Sweden.....				3	1					1							5
Switzerland.....				1									1				2
United States.....	72	69	8	115	63	107	8	7	65	136	236	69	6	8	51	96	1,116
Venezuela.....				1													1
West Indies.....	113	75		27	135	17	1	13	69	16	60	49	29	65	22	185	876
Total.....	190	209	10	155	265	126	19	22	143	171	298	157	36	172	76	362	2,402

APPENDIX II.—DIVISION OF POLICE AND PRISONS.

TABLE 16.—*Authorized strength of division of police and prisons, June 30, 1912.*

Official title.	Number.	Salary.	Official title.	Number.	Salary.
Chief of police.....	1	\$4,000	First-class policemen.....	16	960
Assistant chief of police.....	1	3,300	Policemen.....	11	600
Inspectors.....	2	2,100	Do.....	40	540
Lieutenants.....	4	1,920	Do.....	65	480
Sergeants.....	4	1,890	Senior clerk.....	1	2,100
Do.....	4	1,710	Clerk.....	1	1,800
Corporals.....	10	1,590	Do.....	1	1,650
Do.....	10	1,470	Clerks.....	2	1,500
First-class policemen.....	40	1,290			
Do.....	30	1,200			
First-class policeman(special).....	1	1,200			
First-class policemen.....	30	1,080			
			Total authorized strength of division...	274	.....

TABLE 17.—*Actual strength of division of police and prisons on June 30, 1904-1912.*

Official title.	1904	1905	1906	1907	1908	1909	1910	1911	1912
Chief of police.....	1	1	1	1	1	1	1	1	1
Assistant chief of police.....									
Chief clerk.....		1	1	1	1	1	1	1	1
Senior clerk.....									
Clerks.....	1	4	5	6	8	5	4	4	4
Copyist.....					1				
Inspectors.....							2	2	2
First lieutenant.....	1	1	1	1	1	1			
Second lieutenant.....			1	1	1	1			
Lieutenants.....							4	4	4
First-class sergeants.....		4	9	6					
Sergeants.....	6	4	9	6	10	11	8	8	8
Corporals.....	2	3	15	13	18	18	20	20	19
First-class policemen.....		16	23	59	108	117	112	114	114
Policemen.....	75	98	155	90	93	96	111	115	107
Engineer, police launch.....						1			
Sailor, police launch.....						1			
Total.....	86	132	220	184	242	253	264	270	261

TABLE 18.—*Actual strength of stations and substations on June 30, 1912.*

Station.	Strength.	Station.	Strength.
Headquarters.....	10	Gorgona.....	14
Detective force.....	8	Bas Obispo.....	4
	18	Matachin.....	4
		Frijoles.....	1
Ancon.....	33		23
Naos Island.....	1		
Balboa.....	19	Cristobal.....	40
Sabanas.....	2	Monte Lirio.....	1
Corozal.....	4	Gatun.....	23
Miraflores.....	5	Mount Hope.....	5
Pedro Miguel.....	5	Toro Point.....	3
	69	Porto Bello.....	3
		Quarantine Station.....	1
Empire.....	27		76
Paraiso.....	3		
Cucaracha.....	1	Penitentiary.....	25
Culebra.....	14		
Las Cascadas.....	5	Total.....	261
	50		

TABLE 19.—*Number of arrests, by fiscal years, made in the Canal Zone since organization of division of police and prisons.*

Period.	Arrests.	Period.	Arrests.
June 2, 1904, to June 30, 1905.....	2,130	July 1, 1909, to June 30, 1910.....	6,947
July 1, 1905, to June 30, 1906.....	3,748	July 1, 1910, to June 30, 1911.....	5,959
July 1, 1906, to June 30, 1907.....	5,831	July 1, 1911, to June 30, 1912.....	7,055
July 1, 1907, to June 30, 1908.....	6,075	Total.....	44,020
July 1, 1908, to June 30, 1909.....	6,275		

TABLE 20.—*Number of arrests, by months, made during fiscal year ended June 30, 1912.*

Month.	Arrests.	Month.	Arrests.
1911.		1912.	
July.....	561	February.....	622
August.....	548	March.....	639
September.....	592	April.....	641
October.....	629	May.....	681
November.....	536	June.....	496
December.....	538	Total.....	7,055
1912.		Arrests with warrant.....	2,056
January.....	572	Arrests without warrant.....	4,999

TABLE 21.—*Statement of convictions of persons arrested during fiscal year ended June 30, 1912.*

Month.	Total arrested.	Convictions.	Month.	Total arrested.	Convictions.
1911.			1912.		
July.....	561	442	January.....	572	462
August.....	548	421	February.....	622	501
September.....	592	470	March.....	639	487
October.....	629	511	April.....	641	511
November.....	536	417	May.....	681	554
December.....	538	415	June.....	496	379
			Total.....	7,055	5,570

TABLE 22.—Charges against persons arrested during the fiscal year ended June 30, 1912.

Offense.	Male.	Fe- male.	Total.	Offense.	Male.	Fe- male.	Total.
Abandoning child.....	1	2	3	Intoxication.....	439	5	444
Accessory to larceny.....	4	.....	4	Intoxication and disorderly conduct.....	402	15	417
Adultery.....	5	5	10	Keeping disorderly house.....	1	10	11
Aiding and abetting unlaw- ful practice of midwifery.....	1	.....	1	Lewd and lascivious cohabi- tation.....	47	44	91
Aiding and abetting in rape.....	.....	1	1	Libel.....	5	.....	5
Aiding and abetting in com- mission of a misdemeanor.....	2	.....	2	Loitering.....	308	13	321
Aiding and abetting in as- sault with deadly weapon.....	2	.....	2	Malicious mischief.....	92	3	95
Aiding in escape of prisoners.....	2	.....	2	Maltreating prisoner.....	1	.....	1
Arson.....	4	1	5	Manslaughter.....	4	.....	4
Assault.....	45	2	47	Mayhem.....	3	1	4
Assault and battery.....	547	86	633	Murder.....	3	.....	3
Assault with attempt to com- mit murder.....	5	.....	5	Nonsupport.....	54	.....	54
Assault with deadly weapon.....	66	1	67	Obscene and indecent lan- guage.....	10	3	13
Assault with means likely to produce great bodily harm.....	.....	1	1	Obstructing traffic.....	1	.....	1
Attempt to commit crime against nature.....	5	.....	5	Obtaining money by false pretenses.....	2	.....	2
Attempted burglary.....	1	.....	1	Obtaining property by false pretenses.....	1	.....	1
Attempted larceny.....	6	.....	6	Perjury.....	4	1	5
Attempted robbery.....	2	.....	2	Petit larceny.....	406	10	416
Attempt to commit rape.....	8	.....	8	Posting advertising device on buildings without author- ity.....	1	.....	1
Attempt to defraud.....	58	6	64	Practicing midwifery with- out a license.....	.....	2	2
Battery.....	137	9	146	Promoting cock fights.....	6	.....	6
Bigamy.....	1	1	2	Prostitution.....	.....	3	3
Bribery.....	1	.....	1	Rape.....	8	.....	8
Bringing stolen property into the Canal Zone.....	8	2	10	Receiving stolen property.....	3	.....	3
Burglary.....	78	4	82	Residing in a house devoted to lewdness.....	.....	1	1
Carrying concealed weapons.....	77	.....	77	Returning to Canal Zone after being deported therefrom.....	5	.....	5
Causing false arrest.....	3	3	6	Robbery.....	6	.....	6
Challenging to fight a duel.....	1	.....	1	Straggling from United States military organizations.....	19	.....	19
Civil order of arrest.....	6	.....	6	Subordination of perjury.....	1	.....	1
Compounding a crime.....	1	.....	1	Threats.....	3	.....	3
Contempt of court.....	63	9	72	Trespass.....	54	.....	54
Crime against nature.....	1	.....	1	Trespassing on railroad train.....	209	1	210
Cruelty to animals.....	62	2	64	Unlawfully occupying land after being evicted there- from.....	1	.....	1
Cruelty to children.....	3	.....	3	Uttering a false and forged instrument.....	1	.....	1
Defamation of character.....	.....	1	1	Vagrancy.....	289	23	312
Defilement.....	1	.....	1	Violating automobile regula- tions.....	6	.....	6
Desertion from United States Army.....	1	.....	1	Violating bicycle regulations.....	93	.....	93
Desertion from United States Navy.....	1	.....	1	Violating building regula- tions.....	51	3	54
Desertion from merchant ship.....	15	.....	15	Violating coach tariff regula- tions.....	63	.....	63
Detained for deportation.....	11	1	12	Violating impounding ordi- nance.....	166	5	171
Detained for investigation.....	1	.....	1	Violating license regulations.....	96	1	97
Detained as witness.....	1	1	2	Violating liquor regulations.....	32	3	35
Disorderly conduct.....	967	110	1,077	Violating lottery laws.....	3	.....	3
Disturbing the peace.....	800	172	972	Violating navigation laws.....	28	.....	28
Embezzlement.....	67	5	72	Violating postal regulations.....	6	.....	6
Escaping from jail.....	5	.....	5	Violating quarantine regula- tions.....	1	.....	1
Exhibiting weapons in a threatening manner.....	5	.....	5	Violating revenue laws.....	7	3	10
Extradition.....	4	.....	4	Violating sanitary regula- tions.....	291	32	323
Falsifying evidence.....	3	.....	3	Violating tax regulations.....	2	.....	2
False personation.....	7	.....	7	Violating water regulations.....	3	.....	3
False imprisonment.....	1	.....	1	Violating white-slave-traffic act.....	5	1	6
Fighting.....	72	2	74	Total.....	6,792	619	7,411
Forgery.....	11	.....	11				
Fraud.....	85	3	88				
Gambling.....	83	.....	83				
Grand larceny.....	147	5	152				
Having firearms without per- mit.....	2	.....	2				
Having stolen property in possession.....	1	.....	1				
Hunting at night with a light.....	1	.....	1				
Indecent exposure.....	21	.....	21				
Insanity.....	13	1	14				
Interfering with an officer.....	18	.....	18				

TABLE 23.—*Nationality of persons arrested during fiscal year ended June 30, 1912.*

Nationality.	Number.	Nationality.	Number.
Arabia.....	4	Great Britain—Continued.	
Argentine Republic.....	5	British West Indies—Continued.	
Austria.....	9	Inagua.....	2
Bolivia.....	3	Jamaica.....	1,275
Chile.....	38	Long Island.....	7
China.....	107	Montserrat.....	54
Colombia.....	347	Nevis Island.....	11
Costa Rica.....	22	New Providence.....	54
Cuba.....	14	St. Kitts.....	31
Denmark.....	2	St. Lucia.....	118
St. Thomas.....	8	St. Vincent.....	44
Ecuador.....	16	Trinidad.....	161
Egypt.....	4	Turk Island.....	12
France.....	32	Virgin Island.....	1
Algeria.....	1	Watling Island.....	9
French Guiana.....	5	Greece.....	106
Tunis.....	2	Guatemala.....	3
French West Indies:		Haiti.....	21
Guadeloupe.....	78	Holland.....	3
Martinique.....	326	Dutch Guiana.....	1
St. Martins.....	2	Dutch West Indies.....	1
Germany.....	28	Honduras.....	8
Great Britain:		Italy.....	106
Australia.....	2	Japan.....	2
British Guiana.....	56	Mexico.....	39
British South Africa.....	1	Nicaragua.....	27
British West Africa.....	2	Norway.....	18
Canada.....	13	Panama.....	534
England.....	47	Peru.....	97
India.....	56	Portugal.....	16
Ireland.....	27	Russia.....	3
New Zealand.....	1	Finland.....	10
Scotland.....	9	Spain.....	538
Wales.....	1	Canary Islands.....	1
British West Indies:		Sweden.....	14
Abaco.....	1	Switzerland.....	3
Andros Island.....	2	Turkey.....	1
Antigua.....	125	Armenia.....	1
Barbados.....	1,578	Syria.....	10
Bermuda.....	5	United States.....	517
Cat Island.....	2	Philippine Islands.....	2
Dominica.....	16	Porto Rico.....	10
Fortune Island.....	83	Venezuela.....	12
Grenada.....	93		
		Total.....	7,055

TABLE 24.—*Arrests, by stations, during the fiscal year ended June 30, 1912.*

	1911						1912						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Ancon.....	58	46	58	69	70	36	70	72	68	64	69	75	755
Naos Island.....										10	1	3	14
Balboa.....	17	22	20	46	26	24	21	22	54	33	35	6	326
Las Sabanas.....		1	2		2	7	7	4	9	2	2		38
Corozal.....	10	9	15	5	8	11	6	9	19	21	15	15	143
Miraflores.....	17	16	15	34	28	13	26	18	18	30	36	26	277
Pedro Miguel.....	32	38	29	31	29	27	35	32	39	59	47	27	425
Empire.....	88	74	134	96	80	96	104	127	114	109	138	101	1,261
Paraiso.....	11	19	10	15	18	23	19	21	28	21	10	9	204
Culebra.....	26	26	44	59	24	33	20	37	25	29	38	26	387
Las Cascadas.....	11	7	10	29	10	7	20	13	20	25	13	11	176
Gorgona.....	27	44	37	30	46	32	51	43	42	45	59	35	491
Bas Obispo.....	11	7	7	18	22	12	9	20	14	14	8	12	154
Matachin.....	19	5	5	15	6	14	12	12	5	12	26	7	138
San Pablo.....	2	1	7	5	2								17
Tabernilla.....	4	4	8	6	5	6							33
Frijoles.....										3			3
Cristobal.....	87	110	81	76	64	94	89	92	87	82	75	61	998
Bohio.....	7	4	4	9	4	4	3						35
Monte Lirio.....	1	1			1		1					1	5
Gatun.....	120	90	87	65	76	80	54	69	60	57	73	71	902
Mount Hope.....	2	14	10	10	4	7	12	13	20	15	17	7	131
Toro Point.....	4	2	2	3	4	4	4	4	3	2	8	1	41
Porto Bello.....	7	8	7	6	7	8	9	14	14	8	11	2	101
Total.....	561	548	592	629	536	538	572	622	639	641	681	496	7,055

TABLE 25.—Occupations of persons arrested during the fiscal year ended June 30, 1912.

Occupation.	Number.	Occupation.	Number.
Agents.....	5	Marines.....	28
Attorneys.....	4	Masons.....	8
Bakers.....	54	Mayor.....	1
Barbers.....	11	Merchants.....	183
Bartenders.....	11	Messmen.....	3
Blacksmiths.....	25	Messengers.....	20
Blacksmiths' helpers.....	2	Midwife.....	1
Boatmen.....	6	Miners.....	2
Boilermakers.....	23	Molders.....	5
Boilermakers' helper.....	1	Musicians.....	4
Bootblacks.....	5	No occupation.....	413
Brakemen.....	187	Nurses.....	2
Bricklayers.....	3	Oilers.....	15
Broker.....	1	Orderlies.....	2
Butchers.....	22	Painters.....	22
Carpenters.....	188	Pantrymen.....	2
Car repairers.....	6	Peddlers.....	24
Chauffeurs.....	4	Photographer.....	1
Cheekers.....	4	Physicians.....	3
Chefs.....	2	Pipefitters.....	19
Cigarmakers.....	2	Pitmen.....	2
Clerks.....	95	Plumbers.....	8
Coal passers.....	6	Policemen.....	9
Coachmen.....	124	Porters.....	7
Collectors.....	6	Postmasters.....	1
Conductors.....	16	Powdermen.....	9
Contractors.....	4	Printers.....	2
Cooks.....	63	Prostitutes.....	6
Cooper.....	1	Pumpman.....	1
Cranemen.....	10	Quartermasters.....	4
Dentist.....	1	Real-estate operators.....	12
Distillers.....	2	Restaurant keepers.....	19
Dishwashers.....	3	Riggers.....	8
Diver.....	1	Riveters.....	12
Domestics.....	470	Sailors.....	145
Dredgemen.....	1	Salesmen.....	15
Dressmakers.....	16	Saloon keepers.....	12
Drillmen.....	13	School teacher.....	1
Druggist.....	1	Servant.....	1
Electricians.....	6	Ships' officers.....	16
Electricians' helper.....	1	Shoemakers.....	38
Engineers.....	59	Silversmith.....	1
Farmers.....	308	Soldiers.....	45
Firemen.....	141	Steam fitters.....	2
Fishermen.....	19	Stewards.....	11
Flagmen.....	7	Stonecutter.....	1
Foremen.....	129	Storekeepers.....	8
Gardeners.....	3	Superintendents.....	2
Goldsmith.....	1	Switch tenders.....	68
Harness-makers.....	6	Tailors.....	50
Hostlers.....	14	Teamsters.....	101
Hotel keeper.....	1	Telegraph operators.....	3
Ironworkers.....	16	Telephone operator.....	1
Inspectors.....	5	Timekeepers.....	12
Janitors.....	19	Towerman.....	1
Jewelers.....	2	Trainmen.....	5
Jockey.....	1	Waiters.....	46
Laborers.....	3,293	Washerwomen.....	2
Laundresses.....	41	Watchmakers.....	2
Laundryman.....	1	Watchmen.....	30
Linemen.....	7	Water boys.....	28
Liverymen.....	5	Winchmen.....	4
Machinists.....	50	Yardmasters.....	2
Machinists' helpers.....	5		
Managers.....	3	Total.....	7,055
Manufacturers.....	2		

TABLE 26.—*Crimes committed by prisoners confined in the penitentiary June 30, 1912.*

Crimes.	Number.	Crimes.	Number.
Accessory to grand larceny.....	2	Embezzlement.....	7
Aiding prisoner to escape from peniten- tiary.....	1	Forgery.....	7
Arson (second degree).....	1	Grand larceny.....	41
Assault with deadly weapon.....	10	Manslaughter.....	8
Assault with intent to kill.....	2	Manslaughter (voluntary).....	3
Assault with intent to commit crime against nature.....	1	Murder:	
Assault with means likely to produce great bodily harm.....	1	First degree.....	1
Assault with intent to commit rape.....	1	Second degree.....	5
Bribery.....	1	Rape.....	4
Burglary.....	21	Returning to Canal Zone after being de- ported therefrom.....	1
Burglary:		Robbery.....	1
First degree.....	6	Violating white-slave traffic act.....	3
Second degree.....	10	Uttering a false instrument.....	1
Crime against nature.....	2	Total.....	141

TABLE 27.—*Occupations of prisoners confined in the penitentiary June 30, 1912.*

Occupation.	Number.	Occupation.	Number.
Baker.....	1	Painter.....	1
Bartender.....	1	Photographer.....	1
Blacksmith.....	1	Pipe fitters.....	2
Brakemen.....	8	Pipe fitters' helper.....	1
Carpenters.....	6	Powder men.....	3
Chauffeur.....	1	Restaurant keeper.....	1
Cigar maker.....	1	Riveter.....	1
Clerks.....	5	Sailors.....	4
Conductor.....	1	Salesman.....	1
Contractor.....	1	Saloon keeper.....	1
Cooks.....	4	Shoemaker.....	1
Domestic.....	1	Stevadore.....	1
Drill men.....	3	Steward.....	1
Farmers.....	12	Storekeeper.....	1
Firemen.....	5	Surveyors.....	2
Flagman.....	1	Switchmen.....	3
Foreman.....	1	Teamsters.....	2
Laborers.....	46	Timekeepers.....	3
Machinist.....	1	Waiters.....	3
Masons.....	2	Water boy.....	1
Miner.....	1	Total.....	141
No occupation.....	4		

TABLE 28.—*Nationality of persons confined in the penitentiary June 30, 1912.*

Nationality.	Number.	Nationality.	Number.
Argentina.....	1	Great Britain—Continued.	
Chile.....	2	British West Indies—Continued.	
Colombia.....	8	St. Kitts.....	2
Costa Rica.....	1	St. Lucia.....	1
Ecuador.....	1	Trinidad.....	5
France.....	2	Italy.....	1
Algeria.....	1	Mexico.....	1
French West Indies—		Nicaragua.....	1
Martinique.....	3	Panama.....	18
Germany.....	1	Peru.....	3
Great Britain:		Russia:	
Ireland.....	1	Finland.....	1
British Guiana.....	5	Spain.....	7
British West Indies—		Switzerland.....	1
Antigua.....	3	Turkey.....	1
Barbados.....	31	United States.....	11
Bermuda.....	1	Venezuela.....	1
Grenada.....	3	Total.....	141
Jamaica.....	22		
New Providence.....	1		

TABLE 29.—*Ages of prisoners confined in penitentiary, June 30, 1912.*

Age.	Black.	White.	White American.	Total.
10 to 15 years.....	4			4
15 to 20 years.....	12			12
20 to 30 years.....	72	6	2	80
30 to 40 years.....	21	7	4	32
40 to 50 years.....	4	3	2	9
50 to 60 years.....	2	1		3
60 to 70 years.....	1			1
Total.....	116	17	8	141

Age of youngest prisoner.....	years..	10
Age of oldest prisoner.....	do....	64
Able to read and write.....		102
Unable to read or write.....		39

TABLE 30.—*Causes of deaths investigated by the coroner during fiscal year ended June 30, 1912.*

Causes of death.	Number.	Causes of death.	Number.
Angina pectoris.....	1	Poisoning.....	1
Burns.....	2	Railroad accidents.....	53
Drowning.....	1	Shot (accidentally or with suicidal in-	
Drowning, accidental.....	29	tent).....	2
Dynamite explosion.....	6	Suicide.....	10
Electrocution, accidental.....	5	Traumatism, accidental.....	45
Hemorrhage.....	1	Unknown.....	1
Homicide.....	9		
Natural causes.....	4	Total.....	170

TABLE 31.—*Nationality of persons whose deaths were investigated by the coroner during the fiscal year ended June 30, 1912.*

Nationality.	Number.	Nationality.	Number.
Austria.....	1	Greece.....	2
Colombia.....	7	Haiti.....	1
Ecuador.....	1	Holland:	
France:		Dutch West Indies.....	1
Guadeloupe.....	1	Italy.....	2
Martinique.....	9	Norway.....	1
Great Britain:		Panama.....	17
Canada.....	1	Peru.....	2
England.....	1	Portugal.....	3
India.....	2	Salvador.....	1
British West Indies—		Spain.....	18
Antigua.....	5	United States.....	18
Barbados.....	27	Unknown.....	2
Grenada.....	2		
Jamaica.....	34	Total.....	170
Montserrat.....	2		
St. Lucia.....	5		
Trinidad.....	3		
Watling Island.....	1		

TABLE 32.—*Statement of accidents involving personal injuries investigated during the fiscal year ended June 30, 1912.*

Nationality.	Number.	Nationality.	Number.
Austria.....	1	Great Britain—Continued.	
Belgium.....	2	British West Indies—Continued.	
Colombia.....	13	Nevis Island.....	1
Costa Rica.....	1	St. Kitts.....	2
Cuba.....	1	St. Lucia.....	16
Denmark, St. Thomas.....	1	St. Vincent.....	9
Ecuador.....	2	Trinidad.....	6
France.....	4	Turk Island.....	3*
French West Indies—		Watling Island.....	2
Guadeloupe.....	9	Greece.....	20
Martinique.....	33	Holland, Dutch West Indies.....	1
Germany.....	3	Haiti.....	2
Great Britain:		Italy.....	17
British Guiana.....	5	Mexico.....	3
Canada.....	3	Norway.....	1
England.....	3	Panama.....	65
India.....	9	Peru.....	7
Ireland.....	1	Portugal.....	5
British West Indies—		Russia.....	1
Antigua.....	25	Spain.....	59
Barbados.....	154	Turkey.....	1
Dominica.....	1	United States.....	131
Fortune Island.....	6	Porto Rico.....	6
Grenada.....	16	Unknown.....	1
Jamaica.....	181		
Montserrat.....	16	Total.....	864
New Providence.....	5		

Of the above cases 593 were Isthmian Canal Commission employees, 160 Panama R. R. Co. employees, and 111 nonemployees.

APPENDIX III.—DIVISION OF PUBLIC WORKS.

TABLE 33.—*Consumption of water, collections made in the city of Panama for the fiscal year ended June 30, 1912.*

Quarter ending—	Paying connections.	Consumption per quarter.			Daily average consumption.
		Private.	Public hydrants and taps.	Total.	
		<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>
Sept. 30, 1911.....	1,807	89,598,000	38,069,257	127,667,257	1,387,687
Dec. 31, 1911.....	1,849	89,607,500	42,355,016	131,962,516	1,434,375
Mar. 31, 1912.....	1,912	100,224,781	29,580,353	129,805,134	1,410,924
June 30, 1912.....	1,952	100,931,215	21,397,851	122,329,066	1,344,275
Total for year.....		380,361,496	131,402,477	511,763,973	1,394,315

Quarter ending—	Amount collected from private consumers.	Amount paid by Panaman Government.	Total revenue as per agreement.	Average consumption per private connection per quarter.	Average private quarterly bill.	Cost per hydrant.
				<i>Gallons.</i>		
Sept. 30, 1911.....	\$21,149.30	\$831.65	\$21,980.95	49,583	\$12.91	\$8.40
Dec. 31, 1911.....	23,284.55	(¹)	23,284.55	48,462	12.38	.....
Mar. 31, 1912.....	23,057.90	(¹)	23,057.90	52,418	13.26	.....
June 30, 1912.....	² 25,436.25	(²)	² 25,436.25	51,706	13.03	.....
Total for year.....	92,928.00	831.65	93,759.65	202,169	51.58	8.40

¹ Surplus for quarter.

² Net amount of bills.

TABLE 34.—*Consumption of water and collections made in the city of Colon for the fiscal year ended June 30, 1912.*

Quarter ending—	Pay- ing connec- tions.	Consumption per quarter.				Total.	Average daily con- sumption.
		Private.	Panama R. R. reserva- tion.	Isthmian Canal Commission hospital and quarantine station.	Public hydrants and taps.		
		<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>
Sept. 30, 1911.....	575	38,655,900	8,621,400	4,647,000	33,422,900	85,347,200	927,686
Dec. 31, 1911.....	618	40,877,500	8,541,350	5,330,250	38,108,360	92,857,460	1,009,320
Mar. 31, 1912.....	666	44,026,500	8,936,900	3,687,750	50,385,675	107,036,825	1,176,228
June 30, 1912.....	701	41,842,900	6,040,300	4,126,500	70,058,125	122,067,825	1,341,404
Total for year....		165,402,800	32,139,950	17,791,500	191,975,060	407,309,310	1,113,659

Quarter ending—	Amount collected from private con- sumers.	Amount collected from Panama R. R.	Amount collected from Isthmian Canal Com- mission.	Amount paid or to be paid by Panaman Govern- ment.	Total revenue per quarter.	Average consump- tion per private con- nection.	Average private quar- terly bill.	Cost per hydrant.
						<i>Gallons.</i>		
Sept. 30, 1911.....	\$14,792.25	\$2,436.30	\$1,269.30	\$4,029.24	\$22,527.09	67,227	\$26.81	\$47.96
Dec. 31, 1911.....	15,457.45	2,586.60	1,394.40	3,669.48	23,107.93	66,144	26.69	43.66
Mar. 31, 1912.....	16,573.80	2,521.80	1,599.30	3,244.39	23,939.29	66,105	26.55	38.62
June 30, 1912.....	16,836.00	2,681.40	1,106.40	(1)	20,623.80	59,690	24.01	(1)
Total for year....	63,659.50	10,226.10	5,369.40	10,943.11	90,198.11	259,166	104.06	130.24

¹ Net amount of bills for quarter.

APPENDIX IV.—DIVISION OF SCHOOLS.

TABLE 35.—*Monthly enrollment and average daily attendance.*

	White schools.		Colored schools.	
	Monthly enroll- ment.	Average daily attend- ance.	Monthly enroll- ment.	Average daily attend- ance.
1911.				
October.....	1,174	972.7	931	568.0
November.....	1,262	1,012.8	1,093	687.8
December.....	1,354	977.2	1,217	703.9
1912.				
January.....	1,417	997.5	1,494	776.3
February.....	1,445	971.8	1,567	745.4
March.....	1,477	977.4	1,644	783.6
April.....	1,505	962.3	1,678	728.9
May.....	1,534	904.7	1,746	688.4
June.....	1,556	849.1	1,765	669.1

TABLE 36.—*Total enrollment for the year, by schools.*

White schools:		White schools—Continued.	
Ancon school.....	271	Gatun.....	264
Pedro Miguel.....	84	Cristobal.....	247
Paraiso.....	38	Porto Bello.....	23
Culebra.....	76		
Empire.....	251	Total (gross).....	1,556
Las Cascadas.....	43	Total for all colored schools (gross).....	1,765
Bas Obispo.....	40		
Gorgona.....	219	Total gross enrollment.....	3,321

TABLE 37—*Enrollment by grades.*

	White.	Colored.	Total.
Grade I.....	267	622	889
Grade II.....	203	430	633
Grade III.....	196	222	418
Grade IV.....	127	189	316
Grade V.....	140	63	203
Grade VI.....	97	9	106
Grade VII.....	80	.....	80
Grade VIII.....	61	.....	61
Grade IX.....	43	.....	43
Grade X.....	15	.....	15
Grade XI.....	11	.....	11
Grade XII.....	5	.....	5
Total.....	1,245	1,535	2,780

TABLE 38—*Number of teachers employed.*

	White.	Colored.	Total.
1911.			
October.....	43	24	67
November.....	45	26	71
December.....	46	26	72
1912.			
January.....	46	28	74
February.....	46	28	74
March.....	1 46	28	74
April.....	1 46	28	74
May.....	1 46	28	74
June.....	1 45	28	73

¹ Includes white teacher on silver roll at Cruces school.

Sickness of teachers.

	Number of days.		
	White.	Colored.	Total.
1911.			
October.....	25.0	7.5	32.5
November.....	25.5	4.5	30.0
December.....	30.5	4.0	34.5
1912.			
January.....	38.0	7.0	45.0
February.....	37.0	5.5	42.5
March.....	43.5	1.5	45.0
April.....	32.5	0.0	32.5
May.....	45.5	1.0	46.5
June.....	46.5	2.5	49.0
Total.....	324.0	33.5	357.5

TABLE 39.—*Value of products raised in school gardens.*

	Unit.	Quantity.	Price.	Proceeds.
			<i>Cents.</i>	
Papayas.....	Each.....	233	25	\$58.25
Bananas.....	Bunches.....	30	35	10.50
Tomatoes.....	Pounds.....	510	10	51.00
Beans.....	do.....	337	15	50.55
Lettuce.....	Bunches.....	403	3	12.09
Radishes.....	do.....	125	5	6.25
Turnips.....	do.....	272	3	8.16
Peppers.....	Dozen.....	55	10	5.50
Onions.....	do.....	1	20	.20
Eggplants.....	Each.....	48	3	1.44
Okra.....	Dozen.....	97	10	9.70
Cabbage.....	Each.....	100	5	5.00
Total.....				218.64

APPENDIX V.—CANAL ZONE FUNDS.

TABLE 40.—*Revenues collected from July 1, 1911, to June 30, 1912.*

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
Aerated waters.....	\$739.60	\$2,440.80	\$1,200.40	\$1,478.80	\$5,859.60
Animal licenses.....	22.20	203.70	155.10	81.00	462.00
Auctioneers.....		12.00	8.00	9.00	29.00
Bicycle licenses.....	161.25	161.25	161.25	161.25	645.00
Building rentals.....	3,622.28	2,395.00	1,712.50	12.50	7,742.28
Burial permits.....	487.50	487.50	487.50	487.50	1,950.00
Cabs and coaches.....		171.25	2.75		174.00
Carts.....	691.50	1,055.00	113.00	2,301.00	4,160.50
Chauffeurs' licenses.....	24.25	24.25	24.25	24.25	97.00
Circuit court collections.....	2,122.74	2,122.74	2,122.75	2,122.75	8,490.98
Dance halls.....		100.00	30.00	30.00	160.00
Distilling licenses.....	858.18		4,190.93	34.60	5,083.71
District court collections.....	8,750.60	9,177.20	3,762.31	6,479.68	28,169.79
Gathering coconuts.....				599.70	599.70
Hucksters.....				93.20	93.20
Hunting permits.....	428.75	428.75	428.75	428.75	1,715.00
Insurance tax.....	271.96	271.95	271.96	271.96	1,087.83
Interest.....	5,196.25	5,196.24	5,196.23	5,196.24	20,784.96
Land rentals.....	1,475.65	4,978.18	1,524.52	591.45	8,569.80
Market rentals.....	385.40	2,730.30	703.60	380.60	4,199.90
Marshal fees.....	307.21	753.86	461.23	577.15	2,099.45
Merchandise and drugs.....	794.90	3,706.18	1,656.10	1,933.50	8,090.68
Motor vehicle licenses.....	514.75	514.75	514.75	514.75	2,059.00
Peddling.....	1,204.00	3,452.50	1,047.50	2,463.50	8,167.50
Physicians' licenses.....	33.75	33.75	33.75	33.75	135.00
Police fines.....	113.46	113.45	113.46	113.46	453.83
Poll tax.....	110.00	478.00	70.00	350.40	1,008.40
Pound fees.....	143.23	185.88	97.30	104.06	530.47
Public entertainments.....	45.00	431.90	79.00	122.00	677.90
Real estate tax.....	3,052.10	15,758.37	3,685.00	9,582.64	32,078.11
Restaurants.....	168.00	403.00	218.80	286.20	1,076.00
Retail liquor licenses.....		28,400.00	10,089.88	9,600.00	48,089.88
Retail sale of tobacco.....	747.20	3,362.00	1,642.00	1,906.00	7,657.20
Sale imported meats.....	5.25	3.70	.25	53.36	62.56
Sale impounded animals.....	61.35	72.50	8.00	50.00	191.85
Sale property.....	288.62	288.62	288.62	288.61	1,154.47
School tuition, lost or damaged books.....	219.05	219.06	219.06	219.06	876.23
Services district prisoners.....	6.66			25.20	31.86
Slaughter tax.....	47.00	10,872.50	739.50	736.00	12,395.00
Steamboat inspection.....	709.29	709.30	709.28	709.28	2,837.15
Water tax.....	1,716.28	11,582.90	3,767.16	12,946.55	30,012.89
Total.....	35,525.21	113,298.33	47,536.44	63,399.70	259,759.68
Sale of postage stamps.....					87,441.58
Sale of stamp books.....					199.87
Money-order fees.....					22,871.68
Total.....					370,272.81

TABLE 41.—Expenditures from July 1, 1911, to June 30, 1912.

On account of—	Administrative districts.				Total.
	Ancon.	Empire.	Gorgona.	Cristobal.	
<i>Public improvements.</i>					
Roads and trails:					
Construction.....	\$12,152.15	\$21,353.82	\$7,591.23	\$5,007.81	\$46,105.01
Maintenance.....	3,908.64	12,291.24	1,973.40	1,466.22	19,639.50
Market houses:					
Construction.....					
Maintenance.....	97.63	647.98	291.93	61.96	1,099.50
Operation.....	420.87	570.72	430.54	413.18	1,835.31
Slaughterhouses:					
Construction.....		18.02			18.02
Maintenance.....		66.20			66.20
Operation.....	374.21	446.97	414.29	386.62	1,622.09
Waterworks and sewers:					
Construction.....	77.92	1,531.87	15.34	409.66	2,034.79
Maintenance.....	9.91	2,050.50	378.99	2,230.13	4,669.53
Street lighting.....	98.05	309.18	585.65	212.40	1,205.28
Miscellaneous public works:					
Construction.....	21.61	366.03		393.32	780.96
Maintenance.....	.78	1,247.46	32.45	11.41	1,292.10
<i>Public schools.</i>					
Schoolhouses:					
Construction.....	3,096.95	614.09	1,281.97	3,237.78	8,230.79
Maintenance.....	243.34	1,114.63	489.77	1,635.88	3,483.62
Salaries superintendent, teachers, and clerks.....	15,530.67	15,530.66	15,530.71	15,530.71	62,122.75
Janitor service.....	620.50	1,233.25	715.30	970.00	3,539.05
Furniture and equipment.....	2,478.11	2,163.86	1,372.03	2,016.65	8,030.65
Supplies.....	612.13	813.86	458.86	1,082.37	2,967.22
Traveling and miscellaneous expenses.....	4,554.50	3,199.62	1,746.26	3,122.77	12,623.15
<i>Maintenance administrative districts.</i>					
Salaries district judges.....	3,919.19	3,919.15	3,919.15	3,919.16	15,676.65
Supplies and miscellaneous.....	101.90	415.01	291.33	203.39	1,011.63
Equipment.....	22.24		3.97	12.80	39.01
Zone charity cases, maintenance.....	600.00	600.00	600.00	600.00	2,400.00
District prisoners, maintenance.....	3,431.69	4,606.96	2,085.50	2,379.06	12,503.21
Total.....	52,372.99	75,111.08	40,208.67	45,303.28	212,996.02
<i>Contingent expenses.</i>					
Gratuity penitentiary prisoners.....					892.50
Miscellaneous.....					299.62
<i>Postal service.</i>					
Purchase of stamps.....					31,711.42
Transportation of mails:					
Isthmus.....					15,175.00
Ocean.....					40,722.19
Miscellaneous expenses.....					10,663.00
Total.....					312,459.75

TABLE 42.—Statement of balances in the Canal Zone treasury on June 30, 1912.

Public improvements and schools.....	\$219,883.60
Miscellaneous and contingent.....	8,749.74
Postal receipts, 1912.....	30,468.82
Total.....	259,102.16

APPENDIX VI.—BUSINESS TRANSACTED IN THE COURTS OF THE CANAL ZONE DURING THE FISCAL YEAR ENDED JUNE 30, 1912.

TABLE 43.—*Supreme court.*

	Criminal cases.	Civil cases.		Criminal cases.	Civil cases.
Pending July 1, 1911.....	3	4	Withdrawn.....		
Filed during year.....	3	6	Dismissed.....		1
Affirmed.....	4	6	Habeas corpus proceedings.....		
Reversed.....	1	1	Pending June 30, 1912.....	1	2

Number of sessions of court.....	12
Number of attorneys admitted.....	0

TABLE 44.—*First circuit court.*

CRIMINAL CASES.

Months.	Cases filed.	Con-victed.	Ac-quitted.	Dis-mitted.	Collections.		
					Fines.	Costs.	Total.
1911.							
Cases pending July 1.....	0						
July.....	4	2				\$2.60	\$2.60
August.....	7	4			\$25.00	14.20	39.20
September.....	4	1	3			7.00	7.00
October.....	19	13	2	1	146.00	21.35	167.35
November.....	11	7	2	4	95.00	7.50	102.50
December.....	14	8	1	2	45.00	16.55	61.55
1912.							
January.....	13	8	4	1	52.00	4.60	56.60
February.....	18	9	3	4	60.00	10.50	70.50
March.....	14	10	4	2	221.00	4.90	225.90
April.....	11	7	7	2	124.00	13.50	137.50
May.....	17	13	3		34.00	7.00	41.00
June.....	11	6	3	1	60.00		60.00
Total.....	143	88	32	17	862.00	109.70	971.70

Forfeitures, \$150.

Cases pending June 30, 1912, 6.

CIVIL CASES.

Cases pending July 1, 1911.....	1 11
Cases filed.....	1 198
Cases settled.....	1 176
Cases pending June 30, 1912.....	1 33
Costs.....	\$156.00
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$934.10

¹ Including probate cases.

TABLE 45.—*Second circuit court.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Dis- missed.	Collections.		
					Fines.	Costs.	Total.
1911.							
Cases pending July 1	13						
July	29	16	6	2	\$105.10	\$25.65	\$130.75
August	21	21	6	7	265.00	67.60	332.60
September	34	12	5	2	35.00	16.40	51.40
October	30	21	9	6	270.00		270.00
November	44	35	10	3	155.00		155.00
December	13	10	2	2	81.00		81.00
1912.							
January	16	12	4	3	45.00		45.00
February	19	15	1	1	190.00	7.75	197.75
March	22	10	4	2	114.00		114.00
April	20	15	10	2	87.00		87.00
May	22	10	12	3	55.00	14.40	69.40
June	16	7	1	1	18.00		18.00
Total	299	184	70	34	1,420.10	131.80	1,551.90

Forfeitures, \$625.

Cases pending June 30, 1912, 11.

CIVIL CASES.

Case ending July 1, 1911.....	153
Cases filed.....	170
Cases settled.....	166
Cases pending June 30, 1912.....	157
Insanity cases decided.....	1
Costs.....	\$1,023.63
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$931.63

TABLE 46.—*Third circuit court.*

CRIMINAL CASES.

Months	Cases filed.	Con- victed.	Acquit- ted.	Dis- missed.	Collections.		
					Fines.	Costs.	Total.
1911.							
Cases pending July 1.....	6						
July.....	14	4	2	12	\$12. 50	\$18. 80	\$31. 30
August.....	6	5	2	5	100. 50	14. 45	114. 95
September.....	13	4	2	3	20. 00	9. 00	29. 00
October.....	10	7	1	1			
November.....	5	3	2	25	25. 00		25. 00
December.....	13	8	1	2	50. 00	8. 00	58. 00
1912.							
January.....	20	11	8	34	30. 00	9. 00	39. 00
February.....	14	8	2	41	45. 00	35. 00	80. 00
March.....	17	9	2	1	30. 00	9. 00	39. 00
April.....	10	11	1	53	50. 00	8. 00	58. 00
May.....	4	3		1	65. 00	8. 00	73. 00
June.....	13	8	2	5	100. 00	32. 00	132. 00
Total.....	145	81	25	33	528. 00	151. 25	679. 25

¹ 2 cases remanded.

² 1 case remanded.

³ 1 forfeiture of \$50.

⁴ Forfeiture of \$125.

⁵ 1 forfeiture of \$100.

Cases pending June 30, 1912, 6.

CIVIL CASES.

Cases pending July 1, 1911.....	144
Cases filed.....	65
Cases settled.....	72
Cases pending June 30, 1912.....	137
Costs.....	\$256.00
Proceeds from marriage licenses, recording fees, notarial fees, and miscellaneous fees.....	\$1,170.63

¹ Including probate cases.

TABLE 47 —*District court, district of Ancon.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1911.								
Pending July 1.....	3							
July.....	131	108	13	2	7	\$610.00		\$610.00
August.....	129	91	19	4	14	339.00		339.00
September.....	131	100	23	3	5	366.00		366.00
October.....	183	143	15	23	7	584.00	6.60	590.60
November.....	149	117	17	13	2	753.50		753.50
December.....	114	83	16	11	2	578.50		578.50
1912.								
January.....	170	134	24	9	3	599.50	2.50	602.00
February.....	154	123	13	14	5	677.50		677.50
March.....	190	142	22	22	4	966.00		966.00
April.....	236	197	25	9	2	1,203.00	2.50	1,205.50
May.....	205	168	22	15	3	1,000.50	9.10	1,009.60
June.....	150	125	12	12	1	815.50	2.50	818.00
Total.....	1,945	1,531	221	137	55	8,493.00	23.20	8,516.20

Forfeitures, \$10.
Cases pending June 30, 1912, 1.

CIVIL CASES.

Cases pending July 1, 1911.....	12
Cases filed.....	207
Cases settled.....	210
Cases pending June 30, 1912.....	9
Costs.....	\$267.83
Miscellaneous.....	\$2.57

TABLE 48.—*District court, district of Empire.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1911.								
Pending July 1.....								
July.....	136	87	24	21	3	\$415.00		\$415.00
August.....	125	109	6	9	2	569.50	3.50	573.00
September.....	200	145	30	21	3	551.00		551.00
October.....	203	157	21	22	4	1,427.00	5.90	1,432.90
November.....	128	91	16	18	3	625.50	9.70	635.20
December.....	157	125	23	7	2	993.00		993.00
1912.								
January.....	181	142	23	13	3	549.00		549.00
February.....	216	156	24	33	3	696.00		696.00
March.....	197	145	37	14	1	544.50		544.50
April.....	184	137	31	14	1	838.00		838.00
May.....	218	174	26	13	4	786.00		786.00
June.....	159	120	26	12	3	427.50		427.50
Total.....	2,104	1,588	287	197	32	8,422.00	19.10	8,441.10

Forfeitures, \$135.
Cases pending June 30, 1912, none.

CIVIL CASES.

Cases pending July 1, 1911.....	11
Cases filed.....	593
Cases settled.....	602
Cases pending June 30, 1912.....	2
Costs.....	\$594.10
Notarial fees.....	\$7.00

TABLE 49.—*District court, district of Gorgona.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1911.								
Pending July 1.....								
July.....	70	47	14	6	1	\$190.00		\$190.00
August.....	69	40	15	10	5	204.50		204.50
September.....	70	45	11	4	10	190.00		190.00
October.....	80	52	12	10	5	331.50		331.50
November.....	91	60	13	11	8	280.00		280.00
December.....	67	43	14	4	6	355.00		355.00
1912.								
January.....	76	61	10	3	2	298.00		298.00
February.....	79	49	20	6	3	347.50		347.50
March.....	64	44	11	3	7	257.00		257.00
April.....	77	52	10	9	6	324.00	\$1.85	325.85
May.....	103	65	28	7	3	410.50		410.50
June.....	59	45	8	3	3	232.50		232.50
Total.....	905	603	166	76	59	3,420.50	1.85	3,422.35

Cases pending June 30, 1912, 1.

CIVIL CASES.

Cases pending July 1, 1911.....	3
Cases filed.....	259
Cases settled.....	254
Cases pending June 30, 1912.....	8
Costs.....	\$310.71
Miscellaneous.....	\$29.25

TABLE 50.—*District court, district of Cristobal.*

CRIMINAL CASES.

Months.	Cases filed.	Con- victed.	Acquit- ted.	Commited to circuit court.	Dis- missed.	Collections.		
						Fines.	Costs.	Total.
1911.								
Pending July 1.....	1							
July.....	215	161	32	6	13	\$661.00		\$661.00
August.....	232	170	41	6	19	653.00		653.00
September.....	186	136	29	9	11	643.00		643.00
October.....	174	122	28	9	15	268.00		268.00
November.....	158	101	40	3	13	474.50		474.50
December.....	199	126	41	13	21	663.50	\$1.25	664.75
1912.								
January.....	170	108	31	14	17	187.00	207.20	394.20
February.....	187	123	36	13	15	342.50		342.50
March.....	166	90	35	19	18	540.00		540.00
April.....	169	112	26	9	22	238.00		238.00
May.....	181	117	30	10	22	659.50		659.50
June.....	136	95	20	7	18	541.00		541.00
Total.....	2,174	1,461	389	118	204	5,871.00	208.45	6,079.45

Forfeitures, \$135.

Cases pending June 30, 1912, 2.

CIVIL CASES.

Cases pending July 1, 1911.....	4
Cases filed.....	216
Cases settled.....	214
Cases pending June 30, 1912.....	6
Costs.....	\$265.23

APPENDIX VII.—LEGISLATION.

(For Executive orders see Appendix T.)

No. 1.

Ordinance.

Be it enacted, by the Isthmian Canal Commission, that section 7 of the ordinance providing for certain taxes and licenses in the Canal Zone other than for the sale of intoxicating liquors be, and the same hereby is, amended by adding at the end thereof the following:

Provided, That the collector of revenues may refuse to issue a license for any of the objects named in paragraphs (b), (c), (f), (g), (i), (j), and (k) if the character of the applicant is such as to warrant the belief that the exercise of the privilege granted by the license would not be conducted in an orderly and lawful manner, and *Provided further*; That any license granted pursuant to the provisions of paragraphs (b), (c), (f), (g), (i), (j), and (k) of this section shall at once become null and void upon conviction in any court of the Canal Zone of a violation of law in the exercise of the privilege granted by such license, and *Provided further*; That licenses granted pursuant to the provisions of paragraphs (e), (g), (i), (j), and (k) hereof shall not authorize the exercise of such privileges during the hours from 12:00 midnight to 7:00 a. m.

Enacted by the Isthmian Canal Commission at the 161st meeting, August 5, 1911.

Approved by the Secretary of War, August 22, 1911.

No. 2.

Ordinance providing for night quarantine inspection of vessels at the port of Colon.

Be it enacted by the Isthmian Canal Commission as follows:

SECTION 1. That vessels with perishable cargo arriving at Colon after sunset with the intention of sailing within a few hours or before daylight of the following day, will be received by the quarantine officials until 10 p. m.

SEC. 2. Such vessels shall not be allowed to come to the wharf and shall disembark and embark passengers by means of a tug.

SEC. 3. A tug shall be furnished the quarantine officer for the purpose of the visit of inspection.

SEC. 4. Any vessel, steamship company, or agent of a steamship company requesting this service shall pay to the Isthmian Canal Commission the sum of one hundred dollars (\$100) United States currency in addition to the expense of the tug furnished under section 3 of this ordinance for each vessel so inspected.

Enacted by the Isthmian Canal Commission, August 5, 1911.

Approved by the Secretary of War, August 22, 1911.

No. 3.

Ordinance establishing market regulations for the Canal Zone.

Be it enacted, by the Isthmian Canal Commission, that the following regulations for the conduct of public markets and the leasing of space therein shall be in force on and after their approval by the Secretary of War:

1. The markets are provided as places for the sale to residents of the Canal Zone of meat, fish, vegetables, fruits, and other articles of food, and the space in them will not be leased for any other purpose: *Provided*, That, in the discretion of the superintendent of public works, not more than one-half of the space available in a public market may be leased for the sale of dry goods, groceries, notions, cigars, tobacco, soda water and other soft drinks, and for use as lunch counters and news stands where no application has been received for the leasing of the space for the sale of food products, but the superintendent of public works shall have authority to cancel the assignment of space leased for the purposes enumerated in this proviso, should application be made for such space for use for the sale of food products: *Provided further*, That when space is leased for the sale of dry goods, groceries, notions, cigars, tobacco, soda water and other soft drinks, and for use as lunch counters and news stands, the rate of rental shall be twenty (20) per cent, in advance, over that charged when used for the sale of food products.

2. All assignments of space shall be for the period of one month, beginning on the 16th day thereof and ending on the 15th day of the succeeding month; except that assignments made after the first of any month shall be for a half month, counting from the first of the month, and shall be paid for at one-half the monthly rate; and except also that this shall not apply to tables and other similar space rented by the day and so indicated on the posted plat.

3. There shall be posted in a conspicuous place in each market a plat signed by the superintendent of public works and collector of revenues, showing the sizes and rates of rental of the various stalls and other divisions of space.

4. Application for assignment of space shall be made to the market inspector. If approved, the inspector will issue an assignment, indicating the space assigned, the period of assignment, the purpose for which it is to be used, and the amount of rental to be paid to the deputy collector of revenues. Upon return of the assignment, with the exhibition of the deputy collector's receipt, possession of the space will be given.

5. Not more than one stall or other division of space in each market will be assigned to any one person, except by special authority of the superintendent or assistant superintendent of public works.

6. Lessees of space will not be permitted to make any changes in the arrangement of partitions, shelves, etc. Requests for desired changes will be made of the market inspector. If approved by him, he will secure an estimate of the cost of the work, and upon deposit with him by the lessee of the amount of the estimate the work will be done by the Isthmian Canal Commission. The excess of the deposit, if any, over the cost of the work, will be returned to the lessee.

7. All stalls and other divisions of space shall be thoroughly swept at the close of each day. Special attention shall be given to the spaces used for the sale of meat and fish; the counters, blocks, etc., used in them shall be scrubbed with soap and water as often as necessary to keep them in good sanitary condition. All decayed fruit and vegetables and other dirt and refuse shall be removed and deposited in the sanitary cans provided for that purpose. All articles in bulk shall be kept in bags, barrels, or boxes, so that they can be moved in cleaning. Lessees shall be responsible for the cleanly and sanitary condition of the space assigned them and shall carry out such special instructions to that end as may be given them by the market inspector or his authorized assistant. The market inspector will be responsible for the cleanly and sanitary condition of the market outside of stalls and other space assigned to lessees.

8. Lounging or loitering around the market will not be permitted. Lessees are expected to enforce this prohibition as to the space assigned them.

9. The hour for opening and closing each market shall be fixed by the superintendent of public works, and posted in a conspicuous place in the market.

10. Any complaint respecting a market should be addressed to the superintendent of public works, Ancon, Canal Zone.

11. The continued occupancy of space in any market after the expiration of the period for which rental has been paid is declared a misdemeanor, and upon conviction thereof shall be punishable by a fine not exceeding \$25, or imprisonment in jail not exceeding thirty (30) days, or both, in the discretion of the court. Any other violation of these regulations by a lessee shall be considered sufficient cause for the cancellation of his assignment; but such cancellation shall not relieve the offending person from prosecution under any penal law or ordinance he may violate.

12. These regulations shall be posted in a conspicuous place in each market.

Enacted by the Isthmian Canal Commission, August 5, 1911.

Approved by the Secretary of War, August 22, 1911.

No. 4.

Ordinance providing for the impounding of stray animals.

Be it enacted by the Isthmian Canal Commission, that the ordinance providing for the impounding of stray animals enacted by said commission at its 143d meeting held on April 27, 1908, and approved by the Secretary of War on May 26, 1908, be, and the same is hereby, amended and reenacted in form as follows:

1. It shall be unlawful for the owner or custodian of any horse, colt, mule, ass, bull, steer, cow, calf, hog, goat, or sheep to permit any such animal to be at large within or in the neighborhood of any labor camp, village, or other settlement in the Canal Zone, or on any watershed from which any public water supply is obtained; or to be staked or tethered in such place or in such manner as to be or create a nuisance within or in the neighborhood of any labor camp, village, or other settlement, or on any watershed.

2. Any animal found at large or tethered contrary to the provisions of the first section hereof shall be taken up and impounded by the police: *Provided*, That any such

animal may be taken up by any private individual and delivered to the police for impounding. It shall be unlawful for any person to deliver to the police for impounding any animal other than an animal found at large or tethered contrary to the provisions of the first section hereof.

3. Notice of the impounding of any animal shall be posted by the police in two conspicuous places in the police district in which such animal is impounded for ten days, including the day upon which the animal is impounded. Such notice shall contain a description of the animal and shall state where it is impounded and to whom application should be made for its release. It shall also state that if previous application for the release of the animal is not made, it will be sold before the police station on the tenth day from and including the day on which it is impounded, at an hour to be stated in the notice.

It shall be unlawful for any person other than the owner or custodian, or agent of the owner or custodian, to secure the release of any impounded animal.

4. If application for the release of any impounded animal is not made within eight days from and including the date of its impounding, the police shall make application to the district judge of the district for authority for its sale. If it shall appear to the judge that the provisions of this ordinance have been complied with, and that the animal has not been claimed by the owner or custodian, he shall enter an order authorizing its sale at public cry before the police station of the police district in which it is impounded at the time stated in the notice of impounding posted by the police. The police shall thereupon sell the animal at the hour and place stated to the highest bidder for cash.

5. For each horse, colt, mule, ass, bull, or cow impounded there shall be collected one dollar as a pound fee, and fifty cents per day as a maintenance charge; and for each calf, hog, goat, or sheep fifty cents as a pound fee, and twenty-five cents per day as a maintenance charge.

Before the release of any animal to the owner or custodian, the proper fees and charges shall be collected from him. Upon the sale of any animal under an order of court the court costs shall be deducted from the amount for which the animal is sold and paid over to the district judge. All amounts collected by the police from the owner or custodian of any impounded animal or from its sale, after paying the costs of court, shall be remitted to the treasurer of the Canal Zone as Zone revenues. There shall be returned to the owner or custodian of any animal sold under the provisions of this ordinance, upon application therefor made at any time within one year from the date of such sale, the amount for which the animal was sold, less the pound fees and charges and costs of court.

6. If any impounded animal is suffering from any infectious or contagious disease, or from any disease or injury causing great pain, or is without value, or if no bid is received for any impounded animal offered for sale, the police shall immediately make application to the district judge for authority to destroy it, and the judge shall, if he is satisfied of the facts as stated, enter an order authorizing its destruction.

7. The cost of constructing pounds and feeding impounded animals shall be paid from Canal Zone funds.

8. Any person violating any provision of this ordinance shall be guilty of a misdemeanor, and on conviction thereof, shall be fined not more than twenty-five dollars, or imprisoned not longer than thirty days, or both fined and imprisoned, in the discretion of the court.

9. This ordinance supersedes and repeals the provisions of any ordinance, regulation, or law in force in the Canal Zone prohibiting persons from permitting animals to run at large, or providing for impounding such animals, and the provisions of any other ordinance, regulation, or law in force in the Canal Zone in conflict with it.

Enacted by the Isthmian Canal Commission, August 5, 1911.

Approved by the Secretary of War, August 22, 1911.

No. 5.

Ordinance amending the ordinance providing for the licensing and regulation of motor vehicles in the Canal Zone.

Be it enacted by the Isthmian Canal Commission, as follows:

That the ordinance providing for the licensing and regulation of motor vehicles in the Canal Zone, enacted by the Isthmian Canal Commission at its 158th meeting on August 25, 1910, and approved by the Acting Secretary of War, October 31, 1910, be, and the same is hereby, amended as follows:

Section 1 is amended so that the same shall now read as follows:

"SECTION 1. That, hereafter, there shall be collected and accounted for as other similar taxes, the following license taxes from the owners or operators of motor vehicles

used or employed on the streets or roads of the Canal Zone, viz: (1) Excepting motor cycles, (a) for each motor vehicle operated for the transportation of freight for hire, or for the transportation of merchandise or freight by any merchant or dealer, ninety dollars (\$90) per annum; (b) for each motor vehicle operated for the transportation of passengers for hire, fifty dollars (\$50) per annum; (c) for each motor vehicle operated for pleasure, twenty-five dollars (\$25) per annum; and (II) for each motor cycle, ten dollars (\$10) per annum: *Provided, however,* That for motor vehicles operated over the streets and roads of the Canal Zone which have already been duly licensed and authorized to operate over the streets and roads of the Republic of Panama, and where the licensees are residents of the Republic of Panama, there may be collected, with the approval of the head of the department of civil administration, in lieu of the license taxes above enumerated, license taxes as follows: (I) Excepting motor cycles, (a) for each motor vehicle operated for the transportation of freight for hire, or for the transportation of merchandise or freight by any merchant or dealer, ninety dollars (\$90) per annum; (b) for each motor vehicle operated for the transportation of passengers for hire, thirty dollars (\$30) per annum; (c) for each motor vehicle operated for pleasure, five dollars (\$5) per annum; and (II) for each motor cycle, two dollars (\$2) per annum; if, reciprocally on the various kinds of motor vehicles in this proviso enumerated, which have already been duly licensed for operation over the streets and roads of the Canal Zone, and where the licensees are residents of the Canal Zone, there are exacted and collected in the Republic of Panama total license taxes or charges, per annum, not exceeding the respective license taxes, in this proviso enumerated; and in the event that the reciprocal motor vehicle license taxes of the classes herein enumerated are increased in the Republic of Panama over those herein named, there shall be collected in the Canal Zone, with the approval of the head of the department of civil administration, reciprocal motor vehicle license taxes equal to the total thus reciprocally charged in the Republic of Panama: *And provided further,* That where any motor vehicle licensed in the Canal Zone shall, before the period for which the license is taken expires, be sold or transferred by the licensee to some other person who may desire to continue to use and operate such vehicle over the streets and roads of the Canal Zone, such transferee, by application to the collector of revenues, and upon submission of satisfactory evidence of such purchase or transfer, may have the license transferred to him by indorsement made thereon by the collector of revenues, authorizing such transferee to operate such motor vehicle under such license without the payment of any additional license charge or fee."

Adopted by the Isthmian Canal Commission by letter ballot April 9, 1912.

Approved by the Secretary of War May 1, 1912.

APPENDIX VIII.—STEAMBOAT-INSPECTION SERVICE.

TABLE 51.—*Licenses issued by the board of local inspectors during the fiscal year ended June 30, 1912.*

Masters' licenses:	
Master of steam launches.....	1
Masters of towboats.....	4
Masters of ladder dredges.....	4
	19
Engineers' licenses:	
Chief and second engineers of self-propelling barges.....	2
Chief, second, and third engineers of all classes, dredges.....	6
Engineer of launches.....	1
Engineers of tugboats.....	2
	11
Mates' licenses:	
Mates of dredges, all classes.....	10
Pilots' licenses:	
Pilot of towboats.....	1
Pilots of passenger and cargo steamers, any tonnage.....	33
	34
	64

¹ Of the 9 licenses issued to masters, 4 were issued as joint master-pilot licenses.

TABLE 52.—*Receipts from Steamboat-Inspection Service, December 1, 1911, to June 30, 1912.*¹

Month.	Amount.	Month.	Amount.
1911.		1912.	
December.....	\$15. 15	April.....	\$980. 65
		May.....	311. 95
1912.		June.....	70. 00
January.....	215. 00	Total.....	2,837. 15
February.....	586. 90		
March.....	657. 50		

¹ The order of the President under which collections are made went into force on Nov. 14, 1911.

APPENDIX IX.—DIVISION OF FIRE PROTECTION.

TABLE 53.—Detailed statement of fires during the fiscal year ended June 30, 1912.

Town.	Date.	Description.	Owner.	Total value.	Total loss.	Cause of fire.	How extinguished.
West Culebra.	1911.	Dwelling.	Private.	\$7,500.00	.....	Overheated brazier.	Pails of water.
Gatun.	July 6	Hotel.	Isthmian Canal Commission	20,000.00	\$2.50	Electric wires.	Fire extinguishers.
Pedro Miguel.	July 10	Oil waste in car shed.	do.	.....	.....	Spontaneous combustion.	Line of hose.
Empire.	July 16	Grass.	Isthmian Canal Commission	20.63	.....	Employees burning grass.	Allowed to burn out.
Gatun.	July 17	Oil on ground.	do.	11.00	11.00	Sparks from locomotive.	Thrown dirt on fire.
Miraflores	July 18	do.	Isthmian Canal Commission	.....	.....	Unknown.	Allowed to burn out.
Balboa.	July 19	Ties under pipe line	do.	2,800.00	.....	Explosion of lamp.	Fire extinguisher.
Gorgona.	July 20	Depot at Mamel.	Panama R. R.	600.00	.....	Unknown.	Do.
Empire.	July 20	Dwelling.	Isthmian Canal Commission	6,100.00	5.00	Explosion of alcohol.	Pails of water.
Gatun.	July 22	do.	do.	3,800.00	.....	Sparks from locomotive.	Smothered out.
Colon.	July 25	"Bennington House"	Panama R. R.	7,000.00	.....	Ignited by children.	Burning boards removed.
Gatun.	July 26	False alarm.	Private.	.....	.....	Oil stove.	Allowed to burn out.
Do.	July 27	Playhouse.	Isthmian Canal Commission	6,800.00	.....	Unknown.	Fire extinguisher.
Las Cascadas.	July 30	Dwelling.	do.	32,841.51	15.00	Explosion of alcohol.	Pails of water.
Cristobal.	Aug. 13	Hotel.	do.	6,700.00	.....	Stovepipe.	Smothered out.
Ancon.	Aug. 14	Dwelling.	do.	32,841.51	2.00	do.	Fire extinguishers.
Cristobal.	Aug. 17	Hotel kitchen.	do.	4,300.00	40.00	Lightning.	Do.
Ancon.	Aug. 19	Dwelling.	do.	1,075.00	.....	Unknown.	Cutting wires and pails of water.
Gatun.	Aug. 22	Transformer house.	do.	5,000.00	5,000.00	Burning grease.	Lines of hose and fire extinguishers.
Miraflores.	Aug. 27	(Dwelling and telephone pole and cable.	Private.	76.00	76.00	Unknown.	Fire extinguisher.
Gorgona.	Aug. 29	Hotel.	Isthmian Canal Commission	30,750.00	.....	Unknown.	Assisted Panama fire department.
Panama.	Aug. 30	Dwelling.	do.	.....	.....	do.	Throwing dirt on fire.
Gatun.	do.	Grass near transformer house	Isthmian Canal Commission	1,075.00	.....	Smokestack.	Fire extinguisher.
Empire.	Aug. 31	False alarm.	Isthmian Canal Commission	1,200.00	5.00	Unknown.	Removing burning boards.
Gatun.	Sept. 4	Power plant.	do.	16,019.00	2.00	Unknown.	Lines of hose.
Balboa.	Sept. 7	Machine shop.	Isthmian Canal Commission	4,500.00	15.00	Electric wires.	Fire extinguisher.
Gorgona.	Sept. 7	False alarm.	Private.	1,000.00	5.00	Incendary.	Pails of water.
Balboa.	Sept. 14	Hotel.	Isthmian Canal Commission	550.00	45.00	Unknown.	Line of hose.
Cristobal.	Sept. 17	False alarm.	Isthmian Canal Commission	3,967.00	2.50	Stovepipe.	Fire extinguisher.
Gatun.	Sept. 19	Power plant.	do.	32,841.51	.....	Burning grease.	Do.
Empire.	Sept. 20	Dwelling.	Private.	90.00	37.00	Explosion of gasoline tank.	Pails of water and sand.
Cristobal.	Sept. 22	False alarm.	Isthmian Canal Commission	15,000.00	2.00	Tar boiling over.	Line of hose.
Gatun.	Sept. 24	Y. M. C. A.	do.	.....	.....	.....	.....
Toro Point.	Sept. 26	Dispensary.	Private.	.....	.....	.....	.....
Cristobal.	Sept. 27	Hotel.	Isthmian Canal Commission	.....	.....	.....	.....
Balboa.	Sept. 30	Gasoline launch.	do.	.....	.....	.....	.....
Toro Point.	Oct. 3	Tank of tar near shops.	Private.	.....	.....	.....	.....
			Isthmian Canal Commission	.....	.....	.....	.....

	Oct.	6	Locomotive cab.	do.	250.00	Hot coals.	Dumped fire box. Extinguished by fire department.
Gatun. Panama.	Oct. 15						
Culebra.	Oct. 16		False alarm.	Isthmian Canal Commission		Sparks from locomotive.	Line of hose.
Balboa.	Oct. 17		Scrap lumber.	do.	16,737.34	Stovepipe.	Fire extinguisher.
Pedro Miguel.	Oct. 18		Hotel.				Burned itself out.
Colon.	Oct. 20		False alarm.	Isthmian Canal Commission		Lightning.	Assisted Colon fire depart- ment.
Empire.	Oct. 21		Palm tree.	Private.		Unknown.	Fire extinguisher. Smothered out.
Colon.	Oct. 24		Dwelling.				
Gorgona.	Nov. 4		Laborers' barracks.	Isthmian Canal Commission	414.00	Sparks from locomotive.	
Do.	Nov. 8		Dwelling.	Private.	2,160.00	Explosion of kerosene lamp.	
Ancon.	Nov. 9		False alarm.				
Do.	Nov. 10		do.				
Culebra.	Nov. 11		Motor-car house.	Isthmian Canal Commission	16,300.00	Accidental ignition of gasoline.	Fire extinguisher.
Colon.	Nov. 15		Rubbish.	Panama R. R.		Unknown.	Do.
Las Cascadas.	Nov. 16		do.	Isthmian Canal Commis- sion.		Ignited with oil.	Allowed to burn out.
Miraflores.	Nov. 20		Cement shed.	do.	90,000.00	Burning tar.	Line of hose.
Gatun.	do.		Oil barrels.	do.	7,125.00	Sparks from locomotive.	Fire extinguisher.
Do.	do.		Dwelling.	Private.	5,000.00	Cooking apparatus.	Pails of water.
Do.	do.		Cableway tower.	Isthmian Canal Commis- sion.	20,000.00	Electric wires.	Breaking contact.
Panama.	Nov. 28		False alarm.	Isthmian Canal Commis- sion.		Chimney burning out.	Burned itself out.
Ancon.	Nov. 29		Dwelling.				
Corozal.	Dec. 2		Oil tanks.	do.	52.38	Unknown.	Outside of hydrant district.
Cristobal.	Dec. 4		Gasoline launch.	Private.	50.00	Spontaneous combustion.	Line of hose.
Do.	Dec. 9		Coconut tree.	Isthmian Canal Commis- sion.		Sparks from locomotive.	Do.
Do.	Dec. 13		Rubbish.	Isthmian Canal Commis- sion.		Employees burning rubbish.	Allowed to burn out.
Do.	Dec. 15		Hose-drying tower.			Sparks from locomotive.	Pails of water.
Empire.	do.		Dwelling.	{ do. Private.	7,200.00	Oil stove.	Do.
Balboa.	Dec. 16		Shipways.	Isthmian Canal Commis- sion.	24,000.00	Spontaneous combustion.	Line of hose.
Panama.	Dec. 25		Wholesale house.	Private.		Unknown.	Extinguished by Panama fire department.
Culebra.	Dec. 26		Depot.	Panama R. R.		Defective chimney.	Chimney repaired.
Empire.	Dec. 28		Dump.			Sparks from locomotive.	Line of hose.
Pedro Miguel.	do.		Grass.			do.	Stamped out.
Gatun.	Dec. 29		Dwelling.	Isthmian Canal Commis- sion.	8,200.00	Burning grease.	Throwing ashes on fire.
Empire.	do.		Sidewalk.	do.		Burning grass near sidewalk.	Fire extinguisher.
Miraflores.	do.		Railroad ties.	do.	360.00	Sparks from locomotive.	Pails of water.
Empire.	Dec. 30		Empty cases.	do.	500.00	Burning rubbish.	Line of hose.
Gorgona.	do.		Box car No. 6055.	Panama R. R.	920.00	Spontaneous combustion.	Do.

Mount Hope. Cristobal.....	do. do.....	Grass. Tug Mariner.....	Isthmian Canal Commis- sion.....	70,000.00	10.00	Sparks from locomotive. Burning grease.....	Stamped out. Fire extinguisher.
Gorgona. Cristobal.....	Jan. 14 Jan. 15 do.....	Dump. Shavings. Hotel.....	Isthmian Canal Commis- sion.....			Spontaneous combustion. Unknown. Stovepipe.....	Line of hose. Pails of water. Fire extinguisher.
Gatun.....	Jan. 16	Shavings near planing mill.	do.....	5,000.00		Sparks from locomotive.....	Line of hose and fire extin- guisher.
Paraiso Corozal.....	Jan. 17 Jan. 18	Rubbish. Railroad ties.....	Isthmian Canal Commis- sion.....	350.00		Employees burning rubbish. Sparks from locomotive.....	Line of hose. Do.
Cristobal. Paraiso.....	do Jan. 19	Cocoanut tree. Storehouse.....	do. do.....	10,000.00		do. do.....	Do. Fire extinguisher.
Mount Hope. Empire.....	do do	Grass. Palm tree.....	Isthmian Canal Commis- sion.....			Unknown. Fireworks.....	Stamped out. Line of hose.
Matachin. Pedro Miguel.....	Jan. 20 Jan. 21 do.....	Abandoned trestle. Rubbish. Wooden forms.....	do. do.....			Unknown. Sparks from locomotive.....	Allowed to burn out Line of hose. Do.
Gatun. Tabernilla.....	do do	Platform. Lumber.....	Isthmian Canal Commis- sion. Private.....	3,000.00	50.00	do. do.....	Do. Do.
Corozal. Mount Hope.....	Jan. 23 Jan. 24	Grass. Sawdust.....	Isthmian Canal Commis- sion.....	1,499.00 50.00	10.00 10.00	Hot coals. Sparks from locomotive.....	Do. Do.
Empire. Pedro Miguel.....	do do	Power plant. Scrap ties.....	do. do.....			Unknown. Sparks from locomotive.....	Stamped out. Fire extinguisher.
Gorgona. Gatun.....	Jan. 25 do	Dump. Fuel beside mixer building.	Isthmian Canal Commis- sion.....	94,775.00	150.00	Failure of electric switch. Sparks from locomotive.....	Do. Line of hose.
Pedro Miguel. Do.....	Jan. 26 do	Scrap lumber. Trestle.....	do. do.....	50,000.00		Spontaneous combustion. Sparks from locomotive.....	Do. Do.
Miraflores. Mount Hope.....	do Jan. 27	Telegraph poles. Grass.....	do. do.....		20.00	do. do.....	Allowed to burn out. Line of hose.
Gorgona. Balboa.....	do Jan. 30	Dump. Rubbish.....	do. do.....			Spontaneous combustion. Employees burning rubbish.	Throwing dirt on fire. Fire extinguisher.
Gorgona. Balboa.....	Jan. 31 do	Dump. Abandoned trestle.....	Isthmian Canal Commis- sion.....			Spontaneous combustion. Sparks from locomotive.....	Line of hose. Do. Do.
Do. Miraflores.....	do Feb. 1	Grass. Dwelling.....	do. Private.....			do. do.....	Fire extinguishers and pails of water.
Balboa.....	do	Abandoned trestle.	Isthmian Canal Commis- sion.....	15.00	15.00	Kerosene lamp. Sparks from locomotive.....	Fire extinguisher. Destroyed. Allowed to burn out.
Colon. Gatun.....	do Feb. 2	False alarm. Trestle.....	Isthmian Canal Commis- sion.....	20,000.00		do. do.....	Line of hose.
Do. Pedro Miguel.....	Feb. 3 do	Oil tanks. Lumber.....	do. do.....	150.00		do. do.....	Throwing sand on fire. Line of hose.
Balboa. Gatun.....	do Feb. 4	Railroad ties. Trestle and coal pockets.....	do. do.....	11,405.00	5.00	do. do.....	Do. Fire extinguisher.

APPENDIX IX.—DIVISION OF FIRE PROTECTION—Continued.

TABLE 53.—Detailed statement of fires during the fiscal year ended June 30, 1912—Continued.

Town.	Date.	Description.	Owner.	Total value.	Total loss.	Cause of fire.	How extinguished.
Ancon.....	1912. Feb. 4.	Grass.	Isthmian Canal Commis- sion.	\$267,430.00		Sparks from locomotive.....	Line of hose.
Corozal.....	do.	Grass fire beside hydraulic plant.				Unknown.....	Do.
Empire.....	Feb. 5	Sawdust.				Sparks from locomotive.....	Do.
Culebra.....	do.	Scrap material.	Isthmian Canal Commis- sion.			do.....	Do.
Empire.....	do.	Dwelling.	Private.	325.00	\$302.00	Matches.....	Outside of hydrant district.
Pedro Miguel.....	Feb. 6	Telephone pole.....	Isthmian Canal Commis- sion.	20.00	20.00	Employees burning grass...	Throwing sand on fire.
Porto Bello.....	do.	Y. M. C. A. building.....	do.	7,280.14	3.00	Electric light.....	Fire extinguisher.
Miraflores.....	Feb. 7	Scrap material.	do.			Unknown.....	Line of hose.
Corozal.....	Feb. 9	Railroad ties.....	do.			Sparks from locomotive.....	Fire extinguisher.
Pedro Miguel.....	do.	Grass beside oil barrels.....	do.	350.00		do.....	Line of hose.
Paraiso.....	do.	Timbers.....	do.	80.00	50.00	do.....	Do.
Mount Hope.....	do.	Barge No. 10.....	do.			Explosion in hold.....	Do.
Paraiso.....	Feb. 10	Waste oil.....	do.			Sparks from locomotive.....	Do.
Gatun (Mindi).....	Feb. 11	Pile driver.....	Isthmian Canal Commis- sion.	2,153.40	200.00	Hot coals.....	Do.
Bas Obispo.....	do.	Dwelling.....	do.	414.00		Lighted cigarette.....	Fire extinguisher.
Miraflores.....	Feb. 14	Scrap ties near dwelling.....	do.	250.00		Sparks from locomotive.....	Line of hose.
Pedro Miguel.....	do.	Scrap lumber.....	do.			Electric wires.....	Do.
Miraflores.....	Feb. 15	Cement sacks.....	do.	620.00	.80	Sparks from locomotive.....	Fire extinguisher.
Las Cascadas.....	do.	Dwelling.....	Private.	300.00	300.00	Unknown.....	Line of hose.
Culebra.....	Feb. 16	Grass.....	do.			Sparks from locomotive.....	Stamped out.
Paraiso.....	Feb. 17	Scrap lumber near quarter- master's storehouse.	Isthmian Canal Commis- sion.	30,000.00		do.....	Line of hose.
Balboa.....	Feb. 18	Railroad ties.....	Panama R. R.			do.....	Do.
Paraiso.....	do.	Cinder dump.....	do.			Spontaneous combustion.....	Do.
Colon.....	do.	False alarm.....	do.			do.....	Do.
Balboa.....	Feb. 19	Railroad ties.....	Isthmian Canal Commis- sion.			Sparks from locomotive.....	Do.
Mount Hope.....	do.	Gondola car No. 1551.....	do.	750.00		Hot coals.....	Do.
Do.....	Feb. 20	Gondola car.....	Panama R. R.	752.00		Fire in dump.....	Locomotive standpipe.
Do.....	Feb. 21	Grass.....	do.			Sparks from locomotive.....	Stamped out.
Panama.....	Feb. 23	Dwelling.....	Private.			Lighted candle.....	Assisted Panama Fire De- partment.
Matachin.....	Feb. 24	Bridge.....	Panama R. R.			Sparks from locomotive.....	Pails of water.
Gatun.....	do.	Cable spool and cable.....	Isthmian Canal Commis- sion.	510.00	30.00	do.....	Fire extinguisher.
Miraflores.....	do.	Fuel.....	do.			Unknown.....	Pails of water.

Balboa.....	Feb. 25	Stringers under bridge.	do.....				Sparks from locomotive.....	Do.
Miraflores.....	do.....	Brush.....	Isthmian Canal Commis- sion.				Unknown.....	Line of hose.
Gorgona.....	Feb. 26	Grass and scrap lumber.	do.....				Sparks from locomotive.....	Do.
Las Cascadas.....	do.....	Dwelling.....	do.....	6,700.00		10.00	Unknown.....	Fire extinguishers.
Miraflores.....	do.....	Telephone pole.....	do.....	25.00		12.00	Brush fire.....	Do.
Do.....	Feb. 27	Telephone poles near bridge.	do.....	1,200.00			Sparks from locomotive.....	Pails of water.
Gatun.....	do.....	Trestle.....	do.....	9,770.00		5.00	do.....	Do.
Balboa.....	Feb. 28	Railroad ties.....	Panama R. R.				do.....	Line of hose.
Empire.....	do.....	Railroad scale.....	Isthmian Canal Commis- sion.	2,200.00			Hot coals.....	Pail of water.
Mount Hope.....	Feb. 29	Railroad ties.....	do.....				Sparks from locomotive.....	Do.
Empire.....	Mar. 1	Grass and flat car.....	do.....	1,200.00			do.....	Line of hose.
Miraflores.....	Mar. 2	Trackshifter.....	do.....	2,000.00		15.00	Unknown.....	Pails of water.
Balboa.....	do.....	Grass.....	do.....				Employees burning grass.....	Fire extinguishers.
Mount Hope.....	do.....	do.....	Private.....				Sparks from locomotive.....	Stamped out.
Miraflores.....	Mar. 3	Brush near dwelling.....	Isthmian Canal Commis- sion.	1,500.00			Burning brush.....	Beat out.
Culebra.....	do.....	Coal trestle.....	do.....	30,000.00		25.00	Unknown.....	Line of hose.
Miraflores.....	do.....	Railroad ties.....	do.....				do.....	Allowed to burn out.
Culebra.....	Mar. 4	Coal trestle.....	do.....	30,000.00			do.....	Line of hose.
Panama.....	do.....	Crate.....	Panama R. R.				do.....	Fire extinguisher.
Gatun.....	do.....	Dwelling.....	Isthmian Canal Commis- sion.	8,200.00			Spontaneous combustion.....	Pails of water.
Do.....	Mar. 5	Grass beside power house.....	do.....	364.00			Sparks from locomotive.....	Line of house.
Corozal.....	do.....	Grass.....	Isthmian Canal Commis- sion.	1,500.00		300.00	do.....	Do.
Palo Seco.....	do.....	Brush in garden near build- ings.	do.....				Unknown.....	Do.
Empire.....	do.....	Platform.....	do.....	15.00		2.00	do.....	Fire extinguisher and pails of water.
Palo Seco.....	do.....	Dwelling.....	do.....	300.00		5.00	do.....	Fire extinguishers.
Las Cascadas.....	Mar. 6	Box car No. 322.....	do.....	300.00		50.00	do.....	Pails of water.
Mount Hope.....	Mar. 7	Grass.....	do.....				Sparks from locomotive.....	Beat out.
Do.....	do.....	do.....	do.....				do.....	Do.
Do.....	do.....	do.....	do.....				do.....	Do.
Pedro Miguel.....	do.....	Scrap lumber.....	Isthmian Canal Commis- sion.				do.....	Allowed to burn out.
Empire.....	Mar. 8	Grass beside dwelling.....	{ do..... Private.....	9,400.00 400.00			Employees burning grass.....	Pails of water.
Balboa.....	Mar. 9	Shipways.....	Isthmian Canal Commis- sion.	25,000.00			Sparks from locomotive.....	Do.
Mount Hope.....	do.....	Grass and lumber.....	do.....				do.....	Beat out.
Miraflores.....	do.....	Brush near cement shed.....	do.....				Employees burning brush.....	Line of hose.
Gatun.....	Mar. 10	Grass near shop.....	Isthmian Canal Commis- sion.	1,650.00			Unknown.....	Beat out.
Pedro Miguel.....	Mar. 11	Grass near dwelling.....	do.....				Sparks from locomotive.....	Pails of water.
Empire.....	do.....	Grass and old lumber.....	do.....	3,500.00			Employees burning grass.....	Allowed to burn out.
Pedro Miguel.....	do.....	Oil near tanks and barrels.....	Isthmian Canal Commis- sion.	300.00			Sparks from locomotive.....	Line of hose.
Gatun.....	Mar. 12	Grass.....	do.....				do.....	Fire extinguishers.
Paraiso.....	do.....	Inclinator.....	Isthmian Canal Commis- sion.	110.00		20.00	Unknown.....	Line of hose.

APPENDIX IX.—DIVISION OF FIRE PROTECTION—Continued.

TABLE 53.—Detailed statement of fires during the fiscal year ended June 30, 1912—Continued.

Town.	Date.	Description.	Owner.	Total value.	Total loss.	Cause of fire.	How extinguished.
Gatun	1912. Mar. 13	Stringers and ties	Isthmian Canal Commission.	\$20.00	\$20.00	Sparks from locomotive	Fire extinguishers.
Mount Hope	do	Grass	do			Unknown	Stamped out.
Ancon	do	do	do			Sparks from locomotive	Line of hose.
Paraiso	do	Fuel at incinerator	Isthmian Canal Commission.	110.00	5.00	Unknown	Do.
Mount Hope	do	Grass	do			Sparks from locomotive	Stamped out.
Gatun	Mar. 14	do	do			do	Line of hose.
Balboa	Mar. 15	Shavings	Panama R. R.			Sparks from engine	Pails of water.
Toro Point	do	Rubbish near storehouse	Isthmian Canal Commission.	22,750.00		Employees burning rubbish.	Line of hose.
Gorgona	Mar. 16	Grass and brush	do			Sparks from locomotive	Beat out.
Empire	do	Cocoa and rubber trees.	Private.	5,000.00	2,000.00	Tenant burning brush	Outside of hydrant district.
Gatun	do	Servants' quarters and laundry.	Isthmian Canal Commission.	1,050.00		Unknown	Line of hose.
Cristobal	Mar. 17	Cocanut tree.	do			Sparks from locomotive	Burned itself out.
Culebra	Mar. 18	Rock crusher	do			do	Fire extinguisher.
Empire	do	Dwelling	do	5,000.00	4.00	do	Pails of water.
Paraiso	do	Incinerator	do	2,480.00	45.00	Unknown	Fire extinguisher.
Culebra	do	Rock crusher	do	150.00		Sparks from locomotive	Do.
Gorgona	do	Dwelling	Private.	5,000.00	2.00	do	Pail of water.
Empire	do	Coke bin at shops	Isthmian Canal Commission.	2,000.00	5.00	Cigarette.	Fire extinguishers.
Gatun	do	Grass	do	105,000.00		Unknown	do.
Corozal	Mar. 19	Ties in bridge	Isthmian Canal Commission.	100.00	1.00	do	Pails of water.
Paraiso	do	Native hut.	Private.	100.00	100.00	Hot coals	Outside of hydrant district.
Miraflores	do	Telephone pole	Isthmian Canal Commission.	12.00	3.00	Burning brush	Fire extinguisher.
Gorgona	Mar. 20	Dwelling	do	450.00	15.00	Kerosene stove.	Do.
Do	Mar. 21	Old lumber	do			Sparks from locomotive	Line of hose.
Gatun	do	Boxes near power plant	Private.	15,000.00		Employees burning boxes	Pails of water and sand.
Do	Mar. 23	Grass	do			Sparks from locomotive	Beat out.
Paraiso	do	Machine shops (old)	Isthmian Canal Commission.	14,000.00		Unknown	Fire extinguishers.
Gatun	do	Grass, oil, and waste material.	do			Sparks from locomotive	Do.
Miraflores	Mar. 24	Grass near dwelling	Private.	160.00		Unknown	Beat out.
Mount Hope	do	Grass	do			Sparks from locomotive	Stamped out.

Empire.....	Mar. 25	Sidewalk.....	Isthmian Canal Commis- sion.	Unknown.....	Fire extinguisher.
Porto Bello.....	Mar. 26	Launch.....	Private.....	Accidental ignition of gaso- line.	Splashing water on fire.
Balboa.....	Mar. 27	Old ties.....	Panama R. R.	Sparks from locomotive.....	Line of hose.
Empire.....	Mar. 28	Sidewalk.....	Isthmian Canal Commis- sion.	Burning grass.....	Fire extinguisher.
Mount Hope.....	Mar. 30	Grass.....	Isthmian Canal Commis- sion.	Unknown.....	Throwing sand on fire.
Gatun.....	Apr. 1	Window frames.....	Isthmian Canal Commis- sion.	Sparks from locomotive.....	Pails of water and sand.
Pedro Miguel.....	do.	Grass.....	Isthmian Canal Commis- sion.	Unknown.....	Allowed to burn out.
Empire.....	Apr. 2	Grass and brush.....	Isthmian Canal Commis- sion.	do.	Beat out.
Corozal.....	do.	Sidewalk.....	do.	Burning grass.....	Fire extinguisher.
Culebra.....	do.	Condemned material.....	do.	Employees burning con- demned material.	Allowed to burn out.
Gatun.....	Apr. 4	Waste lumber near tool room and workshop.	do.	Sparks from locomotive.....	Line of hose.
Mount Hope.....	do.	Grass.....	Isthmian Canal Commis- sion.	do.	Do.
Toro Point.....	do.	Shavings near piling.....	do.	do.	Do.
Ancon.....	do.	Kitchen, Tivoli Hotel.....	do.	Burning grease.....	Throwing salt on fire.
Mount Hope.....	Apr. 5	Derrick timber.....	do.	Sparks from locomotive.....	Line of hose.
Balboa.....	Apr. 6	Grass and pipe line.....	do.	Ignited by boy.....	Do.
Gatun.....	do.	Waste lumber near store- house.	do.	Unknown.....	Do.
Mount Hope.....	do.	Fuel.....	do.	Heat from boiler.....	Do.
Balboa.....	do.	Grass near dwelling.....	do.	Ignited by boy.....	Do.
Pedro Miguel.....	do.	Steam shovel No. 107.....	do.	Unknown.....	Outside of hydrant district.
Gorgona.....	Apr. 7	Bridge No. 47.....	do.	do.	Pails of water and tearing up timbers.
Miraflores.....	Apr. 8	Grass.....	Isthmian Canal Commis- sion.	Sparks from locomotive.....	By starting back fires.
Do.....	do.	Scrap lumber.....	do.	do.	Standpipe for locomotives.
Do.....	do.	Telephone poles.....	do.	Unknown.....	Fire extinguisher.
Do.....	do.	Platform.....	do.	do.	Pails of water.
Pedro Miguel.....	Apr. 9	Refuse.....	Isthmian Canal Commis- sion.	do.	Allowed to burn out.
Empire.....	do.	Grass at house No. 133, dwelling.	do.	Accidentally ignited.....	Pails of water.
Pedro Miguel.....	do.	Grass beside commissary.....	Panama R. R.	Sparks from locomotive.....	Do.
Culebra.....	do.	Rock crusher.....	Isthmian Canal Commis- sion.	do.	Do.
Gatun.....	do.	Scrap lumber at oil house.....	do.	do.	Line of hose.
Empire.....	do.	Dump.....	Isthmian Canal Commis- sion.	Unknown.....	Do.
Gorgona.....	do.	Platform.....	do.	Sparks from locomotive.....	Do.
Empire.....	do.	Dump.....	do.	Unknown.....	Do.
Balboa.....	Apr. 10	Grass.....	Isthmian Canal Commis- sion.	Sparks from locomotive.....	Do.
Gatun.....	Apr. 11	Old dynamite house and grass.	do.	Unknown.....	Allowed to burn out.
Miraflores.....	do.	Oakum and excelsior at store- house.	do.	Sparks from locomotive.....	Line of hose.
Do.....	Apr. 13	Native hut.....	Private.....	Unknown.....	Outside of hydrant district.
Mount Hope.....	do.	Sawdust.....	Isthmian Canal Commis- sion.	Employees burning rubbish.....	Line of hose.

APPENDIX IX.—DIVISION OF FIRE PROTECTION—Continued.

TABLE 53.—Detailed statement of fires during the fiscal year ended June 30, 1912—Continued.

Town.	Date.	Description.	Owner.	Total value.	Total loss.	Cause of fire.	How extinguished.
Panama	1912.	False alarm	Isthmian Canal Commission.			Unknown.	Fire extinguisher.
Gatun.	Apr. 15	Dwelling.	do.	\$8,200.00		do.	Line of hose.
Culebra.	do.	Scrap lumber at mill	Panama R. R.	100.00	\$2.00	Employees burning ties.	Allowed to burn out.
Miraflores	Apr. 16	Old railroad ties	Isthmian Canal Commission.			Sparks from locomotive.	Line of hose.
Balboa	Apr. 17	Lidgerwood car No. 1733.	do.	1,126.00	15.00	do.	Pails of water.
Gorgona	do.	Grass near oil tanks.		2,955.00			
Colon	Apr. 18	False alarm	Private.			Overload on wires.	Throwing sand on wires.
Gatun.	Apr. 19	Insulation on electric wires.	do.	50.00	5.00	Overturned lamp.	Fire extinguisher.
Matachin.	Apr. 22	Dwelling.	do.	1,000.00	3.50	Overheated stove.	Do.
Pedro Miguel.	Apr. 26	Hotel kitchen.	Isthmian Canal Commission.	27,734.14		Unknown.	Line of hose.
Empire.	do.	Dump.				Employees burning grass.	Pails of water.
Ancon	Apr. 27	Grass.				Chimney burning out.	Fire extinguisher.
Cristobal.	Apr. 28	Dwelling, chimney	Isthmian Canal Commission.			do.	Pails of water.
Do.	Apr. 30	do.	do.			Hot coals.	Fire extinguisher.
Gorgona	May 1	Dwelling.	do.	650.00		Sparks from locomotive.	Fire extinguisher and pails of water.
Panama	do.	Grass.					
Gatun.	do.	Grass near railroad	Isthmian Canal Commission.	120.00		do.	Do.
Balboa.	May 2	Shed.	do.	100.00	5.00	do.	Line of hose.
Gorgona	do.	Old ties.				Fire in dump.	Do.
Empire.	do.	Tool box.	Isthmian Canal Commission.			Unknown.	Do.
Cofozal.	May 3	Brush fire.				do.	Pails of water.
Mount Hope.	May 4	Grass and rubbish.				Sparks from locomotive.	Beat out.
Do.	do.	Sawdust.	Isthmian Canal Commission.			do.	Stamped out.
Culebra.	May 6	Old ties.	do.	22.00		do.	Line of hose.
Do.	do.	do.	do.			do.	Do.
Miraflores	do.	Platform.	do.	26.00		do.	Pails of water.
Gatun.	May 7	Lumber.	do.	110.00		do.	Line of hose.
Pedro Miguel.	May 9	Old wooden forms.	do.	2,000.00	10.00	do.	do.
Mount Hope.	do.	Sawdust.	do.			do.	Do.
Do.	do.	Old logs and grass.	do.			do.	Stamped out.
Do.	May 11	Kitchen.	Private.			do.	Line of hose
Panama	May 12	Depot.	Panama R. R.	75.00	75.00	Unknown.	Fire extinguisher.
Culebra.	May 13	Dwelling.	Private.	6,000.00		Match.	Throwing lamp out.
Toro Point.	do.	Shavings beside shops	Isthmian Canal Commission.	15,000.00		Explosion of lamp.	Line of hose.
Gatun.	May 15	Hotel.	do.	20,000.00		Stovepipe.	Fire extinguisher.
Paraiso.	May 17	do.	do.	6,263.60		Chimney.	Line of hose.
Gorgona.	do.	Platform at storehouse	do.	202,000.00		Sparks from locomotive.	Pails of water.
Gatun.	May 22	Dwelling.	do.	13,936.00		Electric light.	Smothered out.

Empire.....	May 30	False alarm.....	Isthmian Canal Commission.	2,000.00	5.00	Matches.....	Line of hose.
Miraflores.....	do. 31	Post office.....	Panama R. R.....	2,432.91	100.00	Unknown.....	Do.
Culebra.....	June 5	Freight car No. 8132.....	Isthmian Canal Commission.			do.....	Do.
Miraflores.....	June 6	Tar barrels.....	Isthmian Canal Commission.				
Colon.....	June 18	False alarm.....	Isthmian Canal Commission.	10,000.00		Burning grease.....	Fire extinguisher.
Empire.....	June 19	Dwelling.....	Private.....	1,000.00	10.00	Upsetting of lamp.....	Do.
Mafachin.....	June 20	do.....	Isthmian Canal Commission.	2,650.21		Towels on stove.....	Throwing burning articles
Culebra.....		do.....	do.....	21.70			out.
Porto Bello.....	do.	Canvas cover on hand car.....				Sparks from engine.....	Line of hose.
Ancon.....	June 26	Grass.....				Employees burning grass.....	Allowed to burn out.
Cristobal.....	June 30	Gasoline launch.....	Isthmian Canal Commission.	2,500.00	700.00	Overheated exhaust pipe.....	Line of hose and fire extin-
Empire.....	do.	Store and restaurant.....	Private.....	1,600.00		Wood back of stove.....	guishers.
							Pails of water.
Total for year.....				1,826,995.58	12,653.58		

APPENDIX X.—CANAL ZONE CENSUS.

TABLE 54.—*Population of the Canal Zone, classified by towns, according to census of Feb. 1, 1912.*

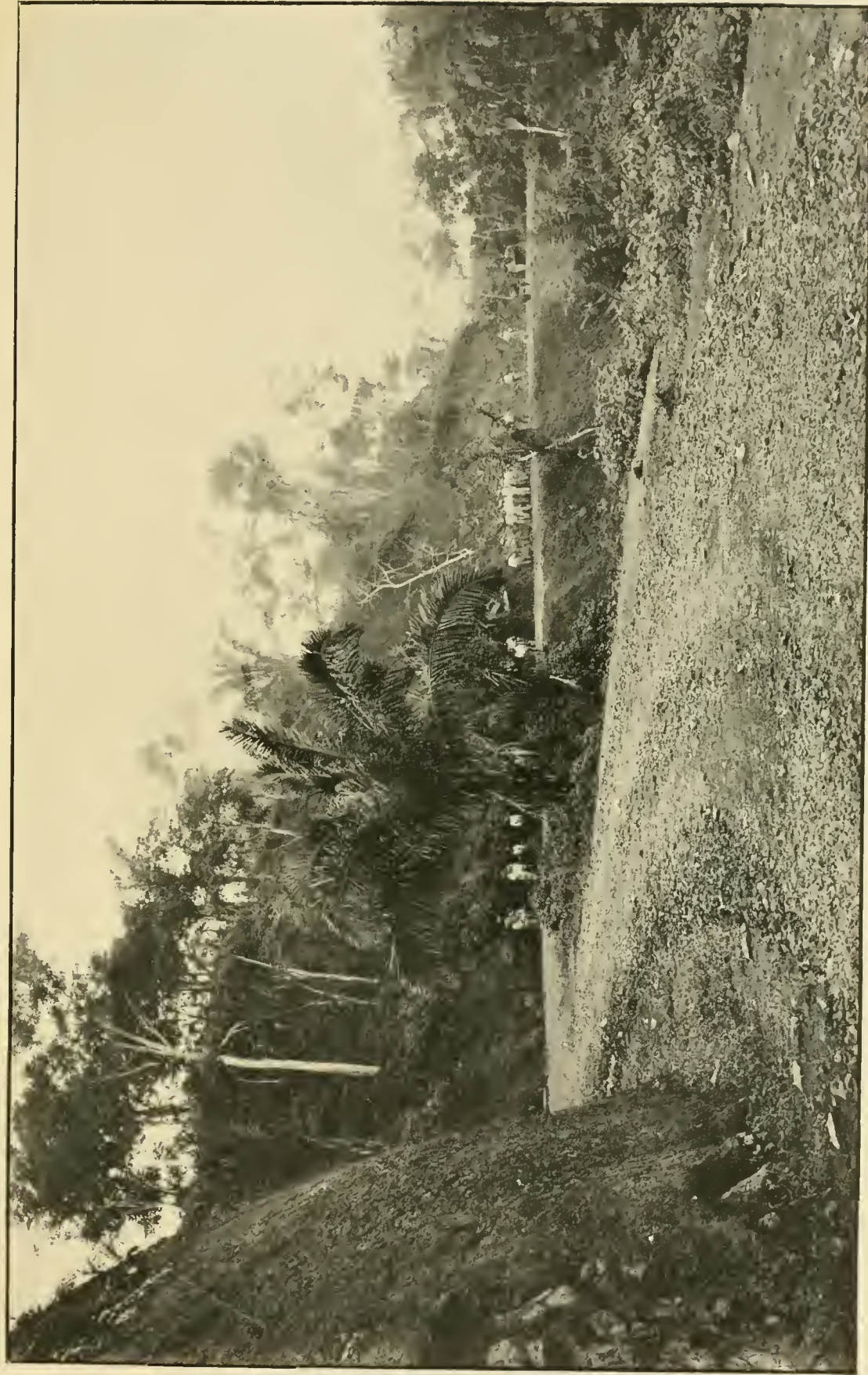
	White.	Black.	Mixed. ¹	Indian.	Yellow.	Hindu.	Fili- pinos.	Total.
<i>Towns.</i>								
Ancon.....	895	724	48		6		1	1,674
Balboa.....	472	531	127		12	4		1,146
Bas Matachin.....	11	479	113	8	2			613
Bas Obispo.....	265	180	23		4			472
Bohio.....	10	251	8		10			279
Caimeto.....		163	95	1				259
Camp Elliott.....	433	10	2					445
Camp Otis.....	878	1					1	880
Cartagenita.....	2	219	16		6			243
Corozal.....	702	218	107	1	7			1,035
Cow Pens.....	1	404	78		14			497
Cristobal.....	1,482	1,949	148		5			3,584
Cruces.....	1	132	36					169
Cucuracha.....	28	240	86		4			358
Culebra.....	939	891	170	1	30	1		2,032
Diablo.....	49	1	2					52
East Balboa.....	470	92	62		9	25		658
Empire.....	1,757	3,701	1,569		101	24		7,152
Enterprise.....	157	69	16					242
Fox River.....	9	105	12					126
Frijoles.....	10	43	41		2			96
Gatun.....	2,895	5,399	530		60	3		8,887
Golden Green.....	7	1,322	224		16	1		1,570
Gorgona.....	1,449	1,369	585	1	33	7		3,444
Haut Obispo.....	186	174	27		2			389
Las Cascadas.....	586	535	55		14			1,190
Las Sabanas.....	60	147	93	1	2			303
Lirio.....		310	10					320
Matachin.....	81	551	138		26			796
Miraflores.....	685	341	144		7	53		1,230
Monte Lirio.....	56	284	41		9			390
Mount Hope.....	55	980	91		8			1,134
New Frijoles.....	33	172	43		1			249
Palo Seco.....	6	59	26		2			93
Paraiso.....	662	1,145	509		23			2,339
Pedro Miguel.....	878	1,069	301		20	10		2,278
Rio Grande.....	492	541	222		22			1,277
San Pablo.....	5	32	18					55
Santa Cruz (Ancon district).....		70	36					106
Tabernilla.....	6	27	14		3			50
Toro Point.....	183	378	37					598
<i>ISLANDS.</i>								
Naos.....	53	77	57			233		420
Culebra.....	7	10	7					24
<i>FLOATING EQUIPMENT.</i>								
Atlantic.....	108	126	12					246
Pacific.....	41	24	132		5			202
<i>RURAL.²</i>								
Ancon administrative district.....	40	334	678		2	3		1,057
Empire administrative district.....	671	2,140	1,994		8	8		4,821
Gorgona administrative district.....	685	2,003	1,094	635	10	1		4,428
Cristobal administrative district.....	61	926	348		36			1,371
Total Canal Zone.....	18,562	30,948	10,225	648	521	373	2	61,279
Colon Beach.....	565	122	52					739
Nombre de Dios.....		42						42
Porto Bello.....	265	406	37			5		713
Taboga.....	21	7	9					37
Total, including Canal Zone proper.....	19,413	31,525	10,323	648	521	378	2	62,810

¹ Largely "mestizo," i. e., a mixture of native Indian and Spanish blood.² This includes many of the smaller communities in the territory contiguous to the Canal and railroad not having any well-defined geographical limits.

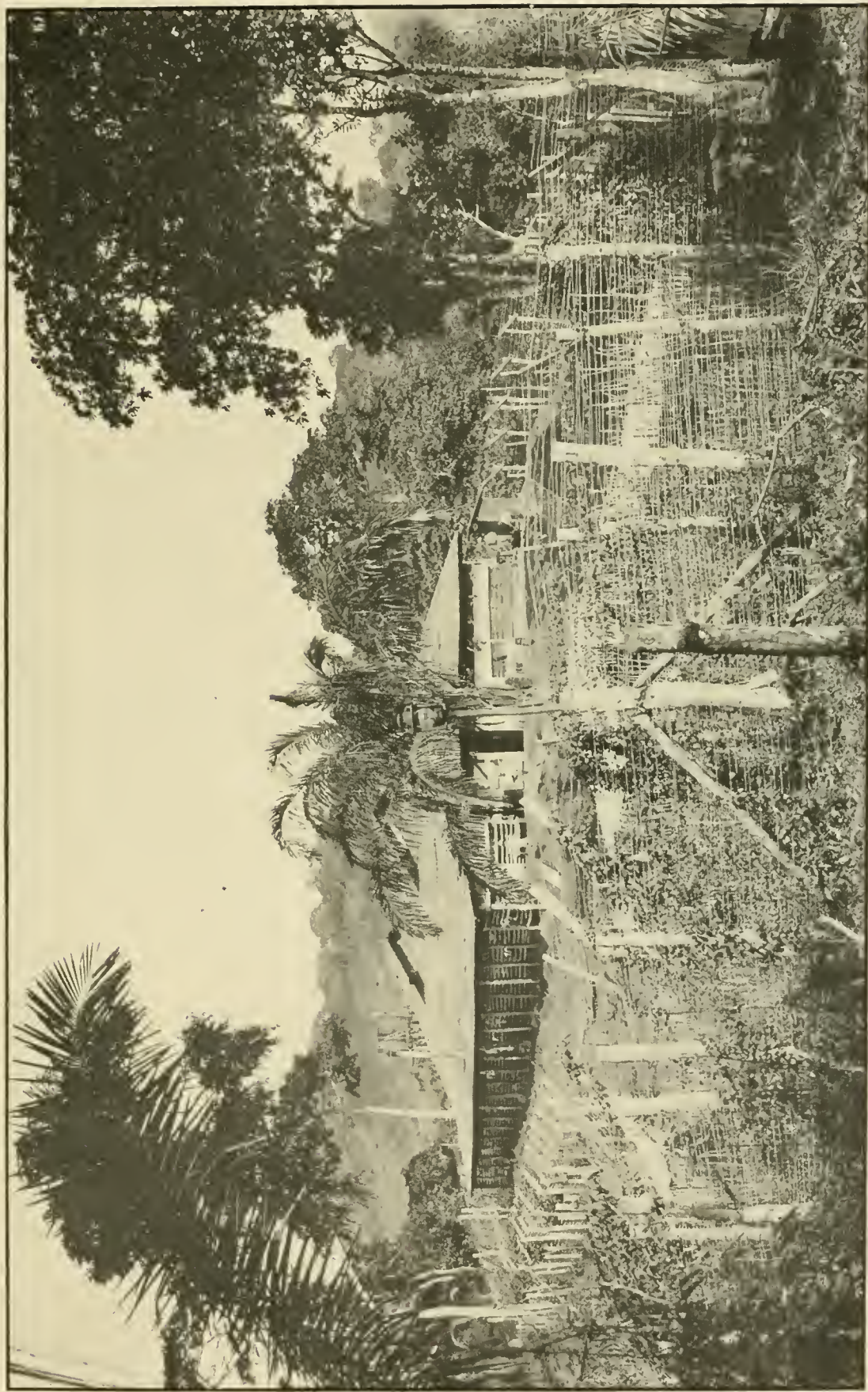
TABLE 55.—*Total population, distributed by country of which citizen or subject, and sex.*

Country.	Aggregate.		
	Total.	Male.	Female.
Argentina.....	9	7	2
Austria-Hungary.....	38	36	2
Belgium.....	4	4	.....
Bolivia.....	14	9	5
Bulgaria.....	1	1	.....
Chile.....	32	27	5
China.....	516	471	45
Colombia.....	1,521	967	554
Costa Rica.....	77	53	24
Cuba.....	72	51	21
Denmark.....	56	35	21
Ecuador.....	43	39	4
France.....	2,760	2,263	497
Germany.....	75	61	14
Great Britain.....	30,859	22,393	8,466
Greece.....	1,291	1,285	6
Guatemala.....	7	3	4
Haiti.....	74	68	6
Holland.....	39	35	4
Honduras.....	6	5	1
Italy.....	812	800	12
Japan.....	5	4	1
Liberia.....	1	1	.....
Mexico.....	72	67	5
Nicaragua.....	73	53	20
Norway.....	25	23	2
Panama.....	7,636	3,903	3,733
Paraguay.....	3	2	1
Peru.....	223	208	15
Portugal.....	119	113	6
Roumania.....	1	1	.....
Russia.....	54	48	6
Salvador.....	11	9	2
Santo Domingo.....	2	2	.....
Spain.....	4,305	3,809	496
Sweden.....	24	20	4
Switzerland.....	14	13	1
Turkey.....	42	36	6
United States.....	11,850	8,199	3,651
Venezuela.....	44	39	5
Total.....	62,810	45,163	17,647





EMPIRE-CHORRERA 16-FOOT MACADAM ROAD UNDER CONSTRUCTION WITH ZONE PRISON LABOR. AUGUST 29, 1912.



MANDINGO STOCKADE FOR ZONE CONVICTS ENGAGED IN ROAD BUILDING. AUGUST, 1912.

APPENDIX O.

REPORT OF HON. FRANK FEUILLE, HEAD OF THE DEPARTMENT OF LAW.

ISTHMIAN CANAL COMMISSION,
DEPARTMENT OF LAW,
Ancon, Canal Zone, July 29, 1912.

SIR: I have the honor to submit herewith a report concerning the work of the department of law for the fiscal year ending June 30, 1912.

The organization of the department remained unchanged throughout the fiscal year just ended.

In addition to the regular duties of the head of this department, he was required to render other services of a special character during the fiscal year 1911-12 in the preparation of data connected with the testimony given by him to various congressional committees which visited the Zone during the autumn and winter of the year 1911.

LEGISLATION.

A considerable number of Executive orders were promulgated by the President for the Canal Zone during the last fiscal year, and practically all of them were prepared in this office or under the supervision and advice of the head of the department. It might be well to refer to these orders in detail.

The Canal Zone had no legislation providing for the inspection of hulls and boilers of ocean-going vessels, and, inasmuch as vessels of that character that had not been inspected anywhere were plying between the Canal Zone and other points, it was deemed advisable to ask for the enactment of legislation upon this important point, so that the commission authorities might be free from responsibility in case of an accident to any of those vessels. On July 21, 1911, the President approved and promulgated an Executive order, which had been previously prepared in this office, providing for the inspection of steam vessels. The order was an adaptation of the laws of the United States upon that subject. All steam vessels carrying passengers are being inspected under that order.

The laws of Colombia and Panama prevailing in the Canal Zone prior to the change of sovereignty permitted cock fights and similar exhibitions. These laws had not been specifically repealed by our Government after American occupation of the Zone, so that there was no adequate law under which cock fighting could be prohibited. To remedy that condition an Executive order was promulgated by the President on August 4, 1911, by the terms of which it was made a penal offense for anyone to instigate or carry on any fights between cocks or other birds, any dog fight, bull fight, or fight between other animals. Since that date there have been no attempts to promote cock fighting in the Canal Zone.

The employees of the canal commission and of the Panama Railroad Co., in order to deposit savings in some safe place on the Zone, had recourse to the practice of obtaining money orders at the various post offices in the Canal Zone, renewing these from time to time. Consequently the postal authorities deemed it expedient to bring the postal savings system of the United States in a modified form to the Canal Zone, and with that end in view this office, at the instance of the head of department of civil administration and with the aid of the collector of revenues, prepared an Executive order upon the subject, which was approved and promulgated by the President on September 8, 1911. The order permits all persons to make deposits in the post offices, but no interest is allowed on the deposits.

In order that signs and bill posters or other advertising devices should not be placed on the lands or property of the United States or the Panama Railroad Co., an Executive order was approved by the President on September 8, 1911, which provided a punishment by fine of not less than \$5 nor more than \$25, or imprisonment not to exceed 30 days, or both such fine and imprisonment, for every act of posting any such sign or other advertising device contrary to the provisions of the order.

The officials in charge of transportation in connection with the construction work complained of the illegal practice of removing the packing or waste from the journal boxes of railroad engines and cars, and to meet that condition the President promulgated an order on September 14, 1911, providing for a punishment by fine of \$100, or imprisonment in jail not exceeding 30 days, or both fine and imprisonment, in such cases.

The Code of Civil Procedure was not very clear as to the requirements regarding pleadings in the district courts. The provisions of the code might have been construed to mean that written pleadings were required in the district courts as well as in the circuit courts. Inasmuch as the intention was that pleadings should be oral in the district courts, except in cases in which the law required the written statement under oath of the parties, an amendment to the code was submitted to the President and approved and promulgated by him on the 26th of September, 1911. This order also amended the law relating to court costs in civil cases, so that the judge of the court may now tax the costs in a suit against either of the parties, or divide the same between them, or direct that neither party to the suit or proceeding should pay costs. The Executive order has effected two very important and necessary changes in the procedure before the courts.

An Executive order was prepared in this office at the instance of the department of sanitation and was approved by the President on the 14th of October, 1911, by the terms of which every physician, druggist, school-teacher, clergyman, midwife, nurse, head of a family, or other person in attendance on or in charge of anyone sick or injured, having knowledge of the existence in any district of the Canal Zone of any of the diseases named in the order, was required to immediately report the same to the district physician or district sanitary inspector. The board of health had promulgated rules and regulations covering this subject, but the rules carried no penalty for their violation, and hence it was necessary to obtain the Executive order in question, so that the regulations might be enforced. The law was necessary in order that the sanitary department might be informed

without delay of the existence of any communicable diseases in any part of the Canal Zone.

The statutory laws of the United States are not applicable to the Canal Zone unless expressly extended thereto by an act of Congress. The local laws contained no provision by which civilians could be punished for purchasing clothing or other allowances of soldiers or sailors in the service of the United States. The presence of United States soldiers and marines on the Canal Zone made it necessary to have legislation on the subject. The deficiency was remedied by the enactment of a provision similar to that prevailing in the United States. This was done by an Executive order of the President of November 15, 1911.

The law relating to notaries did not authorize the appointment of notaries with jurisdiction coextensive with the limits of the Canal Zone, but limited their authority to the boundaries of the district for which they were appointed. The notarial law was amended by the President's order of November 18, 1911, under the terms of which the head of department of civil administration is now authorized to appoint notaries and may vest them with jurisdiction throughout the Canal Zone, or limit that jurisdiction to the notary's district, as in the discretion of the head of department of civil administration may seem proper. In many instances the services of a notary are required when it would be inconvenient to obtain the services of the notary in the district; but by allowing notaries to function everywhere in the Canal Zone, the need of calling on a notary in any particular district is obviated. In this way business can be disposed of with more dispatch.

On December 26, 1911, the President issued an order requiring all persons engaged in the practice of medicine, surgery, dentistry, pharmacy, or midwifery within the Canal Zone to obtain a license from the board of health, and imposing a penalty for failure to comply with its provisions. The order contained a proviso that it shall not be construed to prohibit the practice of the religious tenets of any church in the ministration of the sick or suffering by mental or spiritual remedies, whether gratuitously or for compensation, provided that such sanitary laws, orders, rules and regulations as now are, or hereafter may be, in force in the Canal Zone are complied with; or gratuitous services in case of emergency, or the administration of ordinary household remedies.

At the instance of the head of department of civil administration this office, in conjunction with the collector of revenues, prepared an Executive order to provide a simple method for the administration of the estates of deceased or insane persons who had been in the employ of the Isthmian Canal Commission or the Panama Railroad Co. The Executive order retained many of the provisions of the preexisting laws of the Canal Zone, the material change consisting of the additional jurisdiction given to the collector of revenues by including the estates of insane employees among those which he is now required to administer. The new order also gives the collector of revenues authority to pay over the estates of decedents and insane persons to the diplomatic representatives and consuls of their respective countries under certain conditions. A material change brought about by this order in the existing laws relates to the preference given to the widow, minor children, or dependent relative in necessitous circumstances of the deceased employee. The claim of the

widow, minor children, or dependent relative in necessitous circumstances is superior to that of all other creditors of the estate, but the preference shall not exceed \$500. The Executive order makes another very important change in the existing laws. Heretofore the collector of revenues acted as judge, as well as public administrator, in all cases that came before him. He is now required to submit the cases to the circuit court for approval. That is to say, all matters requiring judicial ascertainment are passed upon by the circuit court in a brief and summary manner, so as not to delay the adjustment and settlement of the estate. It was due to the collector of revenues to relieve him of the responsibility of acting as judge as well as a party in these proceedings, and the change was desired by him.

On April 17, 1912, an Executive order was approved by the President of the United States making it a penal offense for anyone to go upon any place under the control of the United States or the Panama Railroad Co. and reserved and posted by the Government or the company. This Executive order became necessary in order to prevent intrusion upon lands selected and set apart for the purposes of the canal or the railroad.

The Canal Zone laws are in need of revision, so that the legislation might be brought under one complete correlated system. At present the Zone is governed by laws of Colombia, Panaman laws, and the Executive orders of the President and ordinances of the commission. The Colombian laws are scattered throughout a number of books and many of them are inaccessible except to the very few persons who possess a Colombian law library, which includes not only law books but judicial gazettes and other publications. This condition ought to be remedied by embracing all of the Colombian and Panaman laws which it is deemed expedient to keep in one code and repealing all of the others as being inapplicable to prevailing conditions here.

The change from a construction system to an operating one will call for a revision in the administrative laws of the Zone, but until the attitude of Congress toward the canal and the Canal Zone is definitely known through the enactment of a fundamental law this work can not be safely undertaken. It is my opinion that the existing system of administrative laws on the Zone can be materially simplified so as to reduce the operating expenses considerably.

PROSECUTING ATTORNEY'S OFFICE.

The prosecuting attorney's office is under the charge of the prosecuting attorney and the assistant prosecuting attorney. During the last fiscal year criminal matters on the Zone have been under the immediate charge of the assistant prosecuting attorney, inasmuch as the prosecuting attorney has been assisting the head of the department in the adjustment of land claims and others arising from the construction of the canal and in the preparation and conduct of land cases before the courts of the Zone.

Six hundred and fifteen criminal cases were disposed of in the three circuit courts, and in the following proportions:

Cases in the circuit court:	
First circuit.....	160
Second circuit.....	333
Third circuit.....	122
615	

Of the total number of cases disposed of:

Resulted in convictions.....	398
Resulted in acquittals.....	139
Resulted in dismissals.....	66
In which the defendants are fugitives and have not been arrested.....	12
	615

The following statement contains a classification of the criminal cases coming before the circuit courts of the Canal Zone during the fiscal year 1912 (July 1, 1911, to June 30, 1912):

Adultery.....	9
Arson.....	5
Assault and battery.....	28
Assault with a deadly weapon.....	67
Assault with intent to commit murder.....	4
Assault with intent to commit felonies other than murder.....	5
Burglary.....	62
Cheats.....	13
Disorderly conduct.....	17
Embezzlement.....	24
Forgery.....	17
Gambling.....	66
Grand larceny.....	107
Manslaughter.....	4
Murder.....	3
Navigation laws, violation of.....	26
Perjury.....	6
Rape.....	7
Resisting, etc., public officer.....	17
White-slave traffic.....	6
Miscellaneous.....	122
Total.....	615

As compared with the statement for the year ending June 30, 1912, I submit a tabulated statement showing the number and classification of cases and the disposition of the same for the years 1908-9, 1909-10, 1910-11:

1908-9.		1909-10.	
Adultery.....	26	Adultery.....	10
Assault and battery.....	23	Assault and battery.....	27
Assault with a deadly weapon.....	37	Assault with a deadly weapon.....	36
Burglary.....	30	Burglary.....	54
Conspiracy.....	15	Disorderly conduct.....	18
Disorderly conduct.....	21	Embezzlement.....	15
Embezzlement.....	23	Forgery.....	20
Forgery.....	13	Gambling.....	15
Gambling.....	14	Grand larceny.....	92
Grand larceny.....	91	Manslaughter.....	8
Manslaughter.....	1	Murder.....	11
Murder.....	6	Miscellaneous.....	93
Perjury.....	10		
Resisting arrest.....	9	Total.....	399
Miscellaneous.....	88		
		Convicted.....	307
Total.....	407	Acquitted.....	46
		Dismissed.....	39
Convicted.....	235	Fugitives, insane, mistrial.....	7
Acquitted.....	71		
Dismissed.....	101	Total.....	399
Total.....	407		

1910-11.		1910-11—Continued.	
Adultery.....	18	Resisting arrest.....	7
Assault and battery.....	33	Miscellaneous.....	55
Assault with a deadly weapon.....	41		
Burglary.....	52	Total.....	343
Disorderly conduct.....	12		
Embezzlement.....	27	Convicted.....	236
False personation.....	10	Acquitted.....	79
Forgery.....	14	Dismissed.....	27
Grand larceny.....	59	Fugitive.....	1
Manslaughter.....	8		
Murder.....	2	Total.....	343
Perjury.....	5		

It will be observed that there is a considerable increase in the number of criminal cases for the fiscal year 1912. To some extent this increase is accounted for by the large number of prosecutions for gambling—that is to say, 66 cases—and by prosecutions for violation of the navigation laws—that is to say, 26 cases—whereas there were few prosecutions for these offenses in 1910-11, when only 9 gambling and 1 case for violation of the navigation rules came before the courts. But the increase in gambling cases and cases of violation of navigation rules do not count entirely for the increase. There was an increase in the number of other classes of offenses.

It is not believed that there has been in reality any large increase in crime in the Canal Zone, but that this increase is due to greater activity on the part of the police force in bringing additional cases to the notice of the authorities, and likely the reduction of the force on the canal works, and the increase in the idle population in consequence, is responsible for part of the increase in criminal offenses at least.

Criminal cases are disposed of in the Canal Zone with all dispatch, having due regard for the rights of the defendants. That the criminal business is promptly dispatched by the office of the prosecuting attorney is manifested by the fact that the new fiscal year 1912-13 commenced with only 23 criminal cases pending before the three circuit courts. These cases could not be sooner tried under the law, inasmuch as a trial can not be had until after the expiration of certain periods of time, during which the accused is presumed to prepare his defense.

During the fiscal year just ended only four criminal cases were passed upon by the supreme court of the Canal Zone. Two of these cases resulted in an affirmance of the judgment of the circuit court; in one the trial court's finding was reversed. The fourth case was a habeus corpus proceeding brought originally in the supreme court. The writ was dismissed and the contention of the Government sustained. There was one criminal case pending in the supreme court at the beginning of the new fiscal year.

CIVIL CASES.

No congressional authority has been obtained authorizing anyone in the Canal Zone to submit the title of the United States in lands to judicial ascertainment in the Canal Zone. Cases arise occasionally in which unlawful intrusions are made upon public lands, and especially upon those that are being utilized by the Isthmian Canal Commission for canal purposes. Under the circumstances it became necessary to proceed against the intruders. If the land intruded upon has been

set apart for canal purposes, the intruders are ordered to leave, and upon their failure to do so, as has happened in some instances, they are ejected by the police. There can be no question about the legality of such proceedings. As soon as land is set apart for canal purposes the right of the United States to its untrammelled use for that purpose is unquestioned under the treaty, without prejudice to the claimant's right to obtain damages from a joint commission. Hence this office has no hesitancy in having the land cleared of intruders by administrative process. When lands belonging to the Government are intruded upon and are not needed for construction purposes, it is deemed best not to evict the people administratively by use of the police, but to appeal to the courts for that purpose, and a resort to the courts is made upon the theory that all of the lands of the Canal Zone are in the possession of the canal commission as the representative of the President, in the possession of whom the Canal Zone has been placed by act of Congress for the purposes of the canal. Hence the Isthmian Canal Commission has authority, by necessary implication, to protect the possession of the United States in the public lands of the Canal Zone, and to obtain an injunction or other adequate process to prevent intrusions upon those lands, or to remove persons who have unlawfully intruded thereon.

Proceeding upon the theory that has just been explained, several suits were instituted in the courts of the Canal Zone on behalf of the commission, and in others the right of the commission to the possession of land has been defended upon that theory.

Two hundred and twenty-five acres of land situated between the cemetery at Mount Hope and the quartermaster's corral at Cristobal, were recovered in the circuit court of Cristobal for the United States and the Panama Railroad Co. About $62\frac{1}{2}$ acres of this area belongs to the United States and the balance to the railroad company. The recovery was had against Horacio Stevenson, who endeavored to enjoin the railroad company from entering upon the land to obtain spoil from the hills thereon to be used in constructing the railroad company's mole in Limon Bay. The railroad company set up title to the area in question, except for the part belonging to the United States, and as to that part the Isthmian Canal Commission intervened and asked that its possession be protected against the claims of Horacio Stevenson. The suit resulted in a decree enjoining Stevenson from intruding upon the land, and the canal commission and the Panama Railroad Co. are now in the quiet possession of the entire area in accordance with the decree of the court.

Twenty-nine acres of land lying partly in the San Jose de Ballavista tract, owned by the Panama Railroad Co., and partly in lot 2, as shown on the Harrison-Arosemena map and belonging to the United States, were levied upon under an attachment issued in a suit between private parties. The Panama Railroad Co. applied for an injunction to prevent the sale of that portion of the land claimed by it, and also suggested in its petition that the remainder of the land belonged to the United States. The Panama Railroad Co. fully established its claims on the trial of the case, and thereupon the court granted an injunction as to the land belonging to the United States as well as that belonging to the railroad company, and the sale under the attachment was prevented.

Some time ago a suit was instituted in the circuit court at Cristobal by Ricardo Arias and Eusebio Morales against Ruben Arcia et al., asking for the partition of lands claimed by the plaintiffs in the suit through the heirs of Jeronimo Bracho. Large portions of the land sought to be partitioned belong to the United States and to the Panama Railroad Co., and in order to protect their interest against the claims of the plaintiffs in the suit, it was deemed proper to intervene on behalf of the canal commission and the railroad company. The intervention, in so far as the commission was concerned, is limited to an assertion of possession and right of possession, as the agent of the United States on the Canal Zone, the commission not being authorized to submit the Government's title except as an incident to the trial of the right of possession. The issue between the parties in the partition suit and the Panama Railroad Co. involves the title to the land, as well as the right of possession. The proceeding involves some large areas of valuable land situated close to Colon and Cristobal, and includes the Mount Hope settlement.

It was necessary for the commission and the railroad to make extensive surveys in order to separate the lands claimed by the United States and the railroad company from those which are believed to belong rightfully to the heirs and assigns of Jeronimo Bracho, and to locate these lands upon the ground. Several months were employed in this survey work, which is now finished, and this office is hopeful of bringing the case to trial some time during the month of August next.

It became necessary to take additional land at Las Cascadas for the uses of Camp E. S. Otis, occupied by the Tenth Infantry. The land so taken is in dispute with Mr. B. Burns Duncan, who made objections to the land being taken from him. Inasmuch as the right to take this land for governmental purposes under the treaty is undisputed, notwithstanding it may belong to Mr. Duncan, his objection was ignored, leaving him to take his claim for damages before a joint commission. He then applied for a writ of injunction against the commanding officer of the Tenth Infantry, the regimental quartermaster, and the chief quartermaster of the commission, to prevent them from entering upon the land in dispute. An answer was prepared by this office on behalf of the defendants, and upon a hearing the injunction was denied upon the ground that if the property of the plaintiff was taken he had his remedy by presenting a claim before a joint commission, under the provisions of the treaty.

A case was instituted on behalf of the United States against H. V. Seixas to evict him from the possession of certain lots at Gorgona belonging to the United States. While this suit was instituted in the name of the United States, it was substantially on behalf of the Isthmian Canal Commission, inasmuch as it only involved the right of possession to the lots in question. It was simply a forcible detainer proceeding. The case was vigorously contested by the defendant Seixas in the district court, and on appeal to the circuit court, and then by certiorari and mandamus in the supreme court, all of which courts decided against him, and the commission finally obtained possession of the lots with the houses on them.

The cases of the United States *v.* Antonio Andrade and the United States *v.* B. Burns Duncan were dismissed, inasmuch as they involved title to land, and hence the cases in that form were not authorized by Federal statute.

Several disputed land claims are now pending which might be adjusted amicably if the Isthmian Canal Commission or its representatives were authorized by Congress to agree upon boundary lines with the private claimants. In one of the cases this office has assumed the responsibility of adjusting one of these cases, upon the understanding with the private claimant that the agreement would be subject to ratification by Congress. This case involved the adjustment of the boundary dispute with Mr. Eladio Lasso de la Vega, who owns a piece of land in Ancon on the Ancon-Balboa road. He contended that his land extended to the top of Ancon Hill, and if his claim was a valid one his land was being encroached upon by the works of the Ancon quarry. A settlement was effected with him by which he surrendered about 9 acres of the area claimed by him and the Government surrendered about 2 acres of the area which was claimed by this office as belonging to the Government. It is probable that a court would give Mr. Lasso all of the land that has been accorded to him under the agreement. The adjustment leaves all of the slope of Ancon Hill down to the first foothill free of his claim, and it may be utilized now by the United States without question. I am of the opinion that the settlement is beneficial to the interests of the Government, but I was unable to make a definite and final adjustment of the matter for the want of authority.

Several small tracts of land were acquired by the commission authorities from private persons during the last fiscal year by deed, so that the claims in those cases will not be submitted to the joint commission for an adjustment of damages. The purchases so made were the following:

Grantor.	Description of land.	Area.	Consideration.
		<i>Hectares.</i>	
Almillategui, Jeronimo	Piece of land in old La Boca, or Cartagenita, 26 meters and 50 centimeters by 12 meters and 50 centimeters.	.....	\$828
Arias, Tomas	Entire interest in Agua Salud, Buenavista, Palo Matias, Ahorea Lagarto, and Penas Blancas Abajo estates.	379.92	3,800
Duque, J. Gabriel	Unflooded portion of Barro Colorado Arriba	313	3,130
Lopes, M. Caballero	Piece of land in old La Boca, or Cartagenita, 10 meters by 12 meters.	.....	255
Mudarra Minors, by Dr. Danl. Ballen, guardian.	One-fourth interest in Santa Cruz estate (74 hectares under joint commission award, 1908, and 100 hectares in confirmation of contract with French Canal Co.	174	185
Galastica, Jose de la	One-fourth interest in Calle Bruja estate	(1)	280
Galastica, Fabio, Casimiro, Patrocino, and Sebastian.	One-eighth interest in Calle Bruja estate	2 112	140
Galastica, Petra Paula	do.....	2 112	140
Ganson, Stevens, Hinckley, T. C., and Teran, Oscar (interest of Estefana Galastica).	One-fourth interest in Calle Bruja estate	2 112	280
Murga, Lorenza	do.....	2 112	280

¹ Calle Bruja estate land purchased was approximately 112 hectares.

² Approximately.

(In addition to the foregoing, 31 quit-claim deeds were taken by the Panama Railroad Co. from squatters at Toro Point, the total consideration being \$5,578. These settlements are included in the statement showing claims settled. Deeds were also taken from the heirs of Manuel Olivarez for a finca at Gamboa, consideration \$1,300. The purchase of this finca is also included under the statement of claims.)

In addition to the cases above mentioned, affecting the possession of Government lands, several suits were instituted on behalf of the Isthmian Canal Commission to recover moneys due the commission by private parties. In one of these suits the sum of \$1,080, the value of commissary stores embezzled from the commission, was recovered. In another the sum of \$1,250 canal commission money that had been previously embezzled was recovered, and in another the sum of \$275 the amount due the commission authorities for the installation of sanitary plumbing.

There were 538 leases outstanding at the end of the fiscal year 1911-12, covering 286 building lots and 352 hectares of land, which yield an annual rental to the Canal Zone government of \$2,374.77. In addition, 295 revocable licenses were issued during the year for 315 lots in town sites, calling for an annual rental of \$2,529.09, for the use of the Canal Zone treasury. The sum of \$1,536 was obtained for monthly licenses covering 22 rooms in houses belonging to the commission at Gorgona, and \$900 additional for the rental of one house in the same place, making a total of \$2,436, or a grand total for leases, licenses, rental of rooms, and one house of \$7,339.86.

There is a large quantity of Government land occupied in the Canal Zone under leases heretofore issued which have expired. Inasmuch as the lands so occupied will soon be covered by the waters of Lake Gatun, it is deemed inexpedient to renew the leases or to issue licenses to the occupants, and they are being permitted to remain upon the land without charge with the understanding that they remain there at their own risk and must remove whatever improvements they have on the land at their own cost as soon as required to do so by the encroachment of the waters of Lake Gatun; and, if necessary, the commission may require them to remove before their improvements are reached by the waters of the lake.

The following is a statement of the lands and building lots now occupied by private parties under leases and licenses:

	Building lots.			Agricultural.			Revocable licenses.		
	Leases.	Lots.	Amount.	Leases.	Hectares.	Amount.	Licenses.	Lots.	Amount.
Ancon.....	72	72	\$366.77	74	102	\$306.00	7	7	\$146.13
Empire.....	67	69	469.60	155	205	615.00	287	307	2,382.96
Gorgona.....	129	133	422.40	26	38	114.00	1	1	.....
Cristobal.....	12	12	60.00	3	7	21.00	.....	.....	.....
Total.....	280	286	1,318.77	258	352	1,056.00	295	315	2,529.09

	Amount.
Leases, 538; lots, 286; hectares, 352.....	\$2,374.77
Revocable licenses, 295; lots, 315.....	2,529.09
Revocable licenses, 16; rooms, 22.....	1,536.00
Revocable licenses, 1; house, 1.....	900.00

Total (leases and revocable licenses, 850; lots, rooms, and house, 624; hectares, 352)..... 7,339.86

The sum of \$26,233.90 was paid by the Isthmian Canal Commission in settlement of squatters' claims, most of which were for small amounts and involved payment for improvements or squatters' rights to lands which are to be flooded by the waters of Lake Gatun, or to be utilized for other canal purposes. These claims numbered 504 in the aggregate and were settled through this office.

The following tabulated statement shows the number, character, and location of the various claims:

Lands.	Number of claims.	Amount.
Trinidad River:		
Railroad lands.....	14	\$995.00
Republic of Panama lands.....	6	335.00
Chagres River:		
Railroad lands.....	21	666.00
Commission lands.....	111	6,912.00
Gatun River:		
Commission lands.....	16	725.00
Republic of Panama lands.....	14	800.00
Town house settlements.....	238	6,504.50
Watershed settlements.....	16	1,557.50
Toro Point reservation.....	31	5,578.00
Miscellaneous settlements.....	37	2,160.90
Total.....	504	26,233.90

Miscellaneous settlements include settlements incurred in building telephone lines, making surveys, clearing for sanitary purposes, claims arising from dumps and slides, and small claims arising from fortification work.

Out of this total \$8,852 was paid directly by the Panama Railroad Co., which was reimbursed by the Isthmian Canal Commission.

PANAMA RAILROAD MATTERS.

The law department of the Panama Railroad Co. on the Isthmus remains with the same organization as existed when my last annual report was made, and consists of the counsel and chief attorney, who is assisted by the prosecuting attorney and the assistant prosecuting attorney of the Canal Zone, and the Spanish-American lawyer, who appears before the courts of the Republic of Panama on behalf of the railroad. The legal services rendered by the counsel and chief attorney and his assistants to the Panama Railroad Co. continue to be largely of an advisory character, but there has been a very material increase in the number of suits against the company in the Canal Zone courts. This increase is mostly in damage suits for personal injuries. Several of these cases have been settled after the institution of the suit. The following damage suits have been disposed of:

H. H. Rhodes v. Panama Railroad Co. This was an action for \$40,000 for personal injuries. Judgment was rendered against the defendant for \$600, but a compromise settlement was made for \$400, the plaintiff preferring to take this amount rather than have the case go to the supreme court of the Canal Zone on appeal.

James Spears v. Panama Railroad Co. The plaintiff in this suit claimed \$5,000 for personal injuries. A judgment was rendered against the company for \$100, and the amount was paid and the case disposed of.

Robert Stewart v. Panama Railroad Co. The plaintiff sued for the sum of \$5,000 for personal injuries. The suit was compromised and the plaintiff was paid \$355.68 in settlement.

Walter E. Mack v. Panama Railroad Co. The plaintiff instituted this suit for \$50,000 damages on account of personal injuries. The case was adjusted by this office with the plaintiff, who accepted the

sum of \$5,000 in full settlement of his demand, and the suit was dismissed.

In addition to the foregoing cases which have been adjusted, the case of *C. C. Fitzpatrick v. The Panama Railroad Co.*, based upon a claim for \$15,000 for personal injuries, was tried in the circuit court of the third circuit and a judgment in favor of the plaintiff obtained for \$7,000. The case involves the interpretation of Colombian law in force in the Canal Zone, and the decision in this case will have a material bearing on all claims for damages for personal injuries arising against the railroad company in the future, inasmuch as it will establish a precedent; and hence the law department of the railroad is desirous of having a full and complete presentation of the law issues to the supreme court in the Zone, and we are hopeful of obtaining a reversal of the judgment.

There are two cases now pending in the circuit courts against the railroad company in which no trial has been had. One of these is the case of *Peter J. Thull, administrator, v. Panama Railroad Co.* This is an action for \$20,000 damages for personal injuries. The case will be tried in the near future. The other case is that of *Chrissie Sadler v. Panama Railroad Co.*, in which the company is being sued for \$50,000 for personal injuries resulting in the death of the husband of the plaintiff. This case is also in condition to be tried in the near future.

A judgment was recovered in favor of the railroad company for \$170.50, on account of freight charges in the case of *the Panama Railroad Co. v. Ogilvie*. *Ogilvie* has paid the judgment in full with the costs.

Besides the foregoing suits involving money demands the railroad company has had litigation relating to lands. These suits involve, as well as the railroad company, the Isthmian Canal Commission, and have been referred to in the preceding pages of this report, being the cases of *Horacio Stevenson v. The Panama Railroad Co.*, and *The Panama Railroad Co. v. Felix Luna, et al.* There is also pending in the circuit court at Cristobal the case of *Cerezo v. Diaz et al.*, *The Panama Railroad Co.*, intervenor, which involves the title to land at Toro Point across Limon Bay. The land in question has been taken over by the United States for a military reservation since the institution of the suit.

The land at Toro Point is the property of the Panama Railroad Co., acquired under the grant from the Colombian Government, but squatters' rights are being asserted by several claimants. In a number of these cases settlement was made with the squatters by payment to them of the value of their small improvements. Several claims are left unadjusted. In these the parties are asserting ownership in fee simple to the land embraced in the claims. Suit has been instituted on behalf of the railroad in the circuit court at Cristobal against *Eufracia C. de Villalobos et al.* for a portion of the Toro Point lands, and the issues should be tried out in the very near future.

There is a triangular-shaped piece of land lying to the northeast of Colon, part of the land granted to the Panama Railroad Co. by the Government of Colombia, which contains about 12,000 or 15,000 acres. The land is now occupied by various claimants and squatters. It is believed that the larger part of this land can be recovered for the Panama Railroad Co. against these adverse claimants, and with that end in view a suit was instituted on behalf of the railroad company

in the circuit court at Cristobal. The case will probably be tried in August next.

The most important land litigation now pending is that which involves the claim of the heirs and assigns of Jeronimo Bracho, deceased, embracing land in the vicinity of Cristobal and Colon and lying to the south, east, and northeast of those places. It includes a large area claimed by the United States as public land, upon which the Brazos Brook Reservoir and Watershed, the powder magazine, and the Colon-Gatun road are situated, in addition to lands granted to the Panama Railroad by the Government of Colombia, as shown on the Harrison-Arosemena map. The most valuable part of the lands is the area on which the settlement of Mount Hope is situated. This litigation has already been referred to in a previous part of this report. The case will probably be tried in August next.

The Panama Railroad Co. obtained the sum of \$126,622.16 in rentals from leases of its lots in the cities of Panama and Colon and the lots and lands owned by it in the Canal Zone as compared with \$98,688.56 obtained in 1911, an increase in revenues of \$27,933.60. The following tabulated statement shows the number of leases in effect for lots and lands in the cities of Panama and Colon and in the Canal Zone for the years 1911 and 1912, respectively, with the classification and location of leases:

	Leases.		Lots.		Rentals.	
	1911	1912	1911	1912	1911	1912
Colon.....	527	682	480	680	\$52,992.86	\$75,470.60
Fox River.....	60	65	49	64	3,038.00	3,120.20
Gatun.....	160	157	193	185	5,923.00	5,766.80
New Frijoles.....	19	24	21	27	323.00	377.00
Monte Lirio.....		14		19		522.00
Empire.....	353	403	390	441	11,711.10	12,819.60
Culebra.....	283	313	290	324	6,380.20	6,870.40
Panama.....	347	366	423	437	17,671.20	19,823.06
Scattering.....	73	60	73	60	361.00	447.30
Agricultural.....	7	228	7	223	288.20	1,405.20
Total.....	1,829	2,312	1,926	2,465	98,688.56	126,622.16

Miscellaneous lots leased:

Churches.....	53
Parks.....	4
Schools.....	10
Fire stations.....	4
Municipal washhouse.....	1
Total.....	72

The litigation of the Panama Railroad Co. in the courts of the Republic of Panama during the fiscal year just ended consisted of four cases. One of these involved the possession of a lot of land in the city of Panama which was being unlawfully detained by the tenant. After the institution of suit the tenant paid all his rentals and costs of suit and the case was dismissed.

Another of these cases involves a claim against the Panama Railroad Co. for passes over the road under a conveyance to the company for a right of way over lands. The case has been in the courts for some time. It was originally instituted in one of the circuit courts of the city of Panama. A judgment was there rendered against the Panama Railroad Co., and the company appealed the case to the supreme court of the Republic, where it is now pending.

Another of these cases involves the title to lot B, in Juan Ponce Street, in the city of Panama. The suit was instituted in the courts of the city of Panama against the railroad company, and a judgment was therein rendered in favor of the plaintiff and against the company, who took an appeal to the supreme court of the Republic. The issues were submitted to the supreme court, which has the case under advisement, and the decision should be rendered in the very near future.

The remaining case is one in which a suit was instituted against the railroad company upon a claim for passes over the road under a conveyance to the railroad company of a right of way. This case was also instituted in the courts of the city of Panama. The trial court rendered a judgment in favor of the Panama Railroad Co., but upon appeal by the plaintiff to the supreme court of the Republic the decision of the trial court was reversed and rendered against the railroad company.

This case is interesting because of the novel legal issue involved. The Panama Railroad Co. many years ago obtained a right of way for a spur along the shore front in the city of Panama, and as a consideration for the right of way paid the owner the sum of \$9,000 gold and furnished him with 20 carloads of rock. In addition, the railroad agreed to give passes to him and his family, not to exceed five. He is dead and his wife is dead. He left two grown children, and these have families of their own. The Panama Railroad Co. contended that inasmuch as the family of the grantor of the right of way has ceased to exist, the obligation to furnish passes on the part of the railroad had terminated. The supreme court of Panama interprets the word "family" in the contract as being equivalent to heirs, and in consequence has ordered the Panama Railroad Co. to issue not to exceed five passes to the heirs of the deceased grantor. A motion for rehearing has been filed in the court on behalf of the railroad, on which a decision of the court is expected very soon.

There is nothing to be added to the recommendations made in my last annual report in respect to the Panama Railroad Co. The relation of the railroad to the canal in the future is a matter of governmental policy and depends entirely upon the action to be taken by Congress.

Respectfully,

FRANK FEUILLE,
Head of Department of Law.

Col. GEORGE W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

APPENDIX P.

REPORT OF COL. W. C. GORGAS, MEDICAL CORPS, UNITED STATES ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, CHIEF SANITARY OFFICER, HEAD OF THE DEPARTMENT OF SANITATION.

ISTHMIAN CANAL COMMISSION,
OFFICE OF THE CHIEF SANITARY OFFICER,
Ancon, Canal Zone, July 22, 1912.

SIR: I have the honor to submit herewith the annual report of the department of sanitation for the fiscal year ending June 30, 1912.

Statistics as to the death rate among employees of the Isthmian Canal Commission and Panama Railroad Co. for the fiscal year just closed compared with similar figures for previous years since 1906 are shown below:

WHITE EMPLOYEES.

Year.	Average number.	Total deaths.	Annual average per 1,000.	Year.	Average number.	Total deaths.	Annual average per 1,000.
1906-7.....	7,727	123	15.93	1909-10.....	11,954	108	9.03
1907-8.....	12,058	185	15.34	1910-11.....	12,891	129	10.01
1908-9.....	12,299	147	11.95	1911-12.....	12,380	114	9.21

BLACK EMPLOYEES.

1906-7.....	24,587	1,150	45.94	1909-10.....	38,581	440	11.40
1907-8.....	20,999	604	19.48	1910-11.....	36,238	428	11.81
1908-9.....	31,962	383	11.98	1911-12.....	37,628	394	10.47

ALL EMPLOYEES.

1906-7.....	32,314	1,273	39.41	1909-10.....	50,535	548	10.84
1907-8.....	43,057	789	18.32	1910-11.....	49,129	557	11.34
1908-9.....	44,261	530	11.97	1911-12.....	50,008	508	10.16

For the same period the death rate of the total population of the cities of Panama and Colon and of the Canal Zone was as follows:

Year.	Average population.	Total deaths.	Annual average per 1,000.	Year.	Average population.	Total deaths.	Annual average per 1,000.
1906-7.....	87,215	3,670	42.08	1909-10.....	144,614	2,735	18.91
1907-8.....	112,002	3,100	27.67	1910-11.....	154,255	3,409	22.10
1908-9.....	127,362	2,807	22.04	1911-12.....	159,547	3,163	19.82

The death rate among white employees from the United States for the past five fiscal years was:

Year.	Average number.	Deaths, all cases.	Annual average per 1,000.	Year.	Average number.	Deaths, all cases.	Annual average per 1,000.
1907-8.....	5,035	41	8.14	1910-11.....	6,163	33	5.35
1908-9.....	5,126	42	8.19	1911-12.....	5,934	35	5.90
1909-10.....	5,573	31	5.56				

For the same period the death rate among the white employees from the United States and their families on the Canal Zone was:

Year.	Average number.	Deaths, all cases.	Annual average per 1,000.	Year.	Average number.	Deaths, all cases.	Annual average per 1,000.
1907-8.....	7,040	59	8.38	1910-11.....	10,500	58	5.52
1908-9.....	8,105	64	7.89	1911-12.....	10,410	66	6.34
1909-10.....	9,198	54	5.87				

Adding to the above figures the officers and men of the Tenth Infantry, the Marine Corps, and their families, the death rate was 5.43 per thousand.

Among all employees there were during the fiscal year just closed 154 deaths from violence, as against 178 for the year 1910-11.

Deaths of employees from tropical diseases, and from lobar pneumonia, pulmonary tuberculosis, and typhoid fever for the past six fiscal years were as follows:

	1906-7	1907-8	1908-9	1909-10	1910-11	1911-12
Dysentery.....	58	35	10	13	18	13
Malaria.....	205	98	47	45	41	21
Black-water fever.....	6	13	22	6	9	15
Liver abscess.....	5	11	8	6	8	7
Pneumonia.....	466	175	60	77	83	82
Pulmonary tuberculosis.....	6	60	38	5	28	26
Typhoid fever.....	95	42	19	16	9	8

The daily sick rate for employees which includes the sick in hospitals, sick camps and quarters was 22.91 per thousand compared to 23.01 for 1909-10 and 24.77 for 1910-11.

The daily per capita cost of subsistence for all patients was \$0.252. The per capita cost of patients treated in hospitals was \$1.22 per day. Deducting from this amount the receipts for treatment of patients not entitled to free treatment, the net per capita cost was \$0.96 per day.

The morbidity rate of malaria is taken as an index for health conditions on the Isthmus. The following table shows the admission rate per 1,000 since 1904 of employees sick with malaria:

	Per thousand.
1904-5.....	162
1905-6.....	727
1906-7.....	625
1907-8.....	287
1908-9.....	312
1909-10.....	183
1910-11.....	202
1911-12.....	143

Very respectfully,

W. C. GORGAS,
Chief Sanitary Officer.

Col. GEO. W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

VITAL STATISTICS, FISCAL YEAR 1911-12.

Deaths of employees of the Isthmian Canal Commission and Panama R. R. Co.

Color.	Average number of employees.	Total number of deaths from—			Annual death rate per 1,000.		
		Disease.	Violence.	All causes.	Disease.	Violence.	All causes.
White.....	12,380	68	46	114	5.49	3.72	9.21
Colored.....	37,628	286	108	394	7.60	2.87	10.47
Total.....	50,008	354	154	508	7.08	3.08	10.16

Deaths in the cities of Panama and Colon and the Canal Zone.

Place.	Popula- tion.	Deaths.	Annual average per 1,000.
Panama.....	46,887	1,347	28.73
Colon.....	20,091	503	25.04
Canal Zone.....	92,569	1,313	14.18
Total.....	159,547	3,163	19.82

NOTE.—The figures relating to the number of employees are compiled from the pay rolls of the different months of the year. The population and deaths as given for the cities of Panama, Colon, and the Canal Zone, include employees and civil population.

Total admissions of employees to hospitals and sick camps, including those sick in quarters..... 40,093
Average per 1,000 of admissions of employees to hospitals and sick camps, including those sick in quarters..... 807

Deaths by age, color, and sex.

Age.	White.			Colored.			Yellow.			Total.		
	Male.	Fe-male.	Total.	Male.	Fe-male.	Total.	Male.	Fe-male.	Total.	Male.	Fe-male.	Total.
Under 1 year.....	90	61	151	468	334	802	3	.....	3	561	395	956
1 to 4 years.....	25	12	37	113	105	218	.....	1	1	138	118	256
5 to 10 years.....	3	5	8	14	22	36	.....	.....	.....	17	27	44
11 to 20 years.....	10	7	17	87	54	141	1	.....	1	98	61	159
21 to 30 years.....	67	12	79	397	177	574	11	.....	11	475	189	664
31 to 40 years.....	68	19	87	228	127	355	10	.....	10	306	146	452
41 to 50 years.....	56	8	64	164	67	231	2	1	3	222	76	298
51 to 60 years.....	30	7	37	83	30	113	3	.....	3	116	37	153
61 to 70 years.....	10	6	16	41	20	61	.....	.....	.....	51	26	77
71 to 80 years.....	6	2	8	10	17	27	2	.....	2	18	19	37
81 to 90 years.....	3	3	6	1	4	5	.....	.....	.....	4	7	11
91 to 100 years.....	.....	.....	.....	1	.....	1	.....	.....	.....	1	.....	1
101 to 110 years.....	1	.....	1	.....	1	1	.....	.....	.....	1	1	2
Unknown.....	4	2	6	39	7	46	1	.....	1	44	9	53
Total.....	373	144	517	1,646	965	2,611	33	2	35	2,052	1,111	3,163

Deaths by nationality.

Nations.	Em- ployees.	Nonem- ployees.	Total.	Nations.	Em- ployees.	Non- employees.	Total.
Antigua.....	13	19	32	Jamaica.....	121	556	677
Austria.....	1	1	2	Japan.....	.....	1	1
Bahama Islands....	3	.....	3	Martinique.....	22	60	82
Barbados.....	111	269	380	Mexico.....	2	4	6
Bavaria.....	.....	1	1	Montserrat.....	8	9	17
Bolivia.....	.....	1	1	Nassau.....	3	1	4
Canada.....	.....	2	2	Nevis.....	.....	1	1
Chile.....	1	4	5	Nicaragua.....	.....	5	5
China.....	.....	32	32	Norway.....	2	.....	2
Colombia.....	13	138	151	Panama.....	14	1,222	1,236
Costa Rica.....	.....	8	8	Peru.....	.....	14	14
Cuba.....	1	7	8	Porto Rico.....	.....	2	2
Curacao.....	.....	1	1	Portugal.....	3	1	4
Demerara.....	9	6	15	Russia.....	.....	1	1
Dominica.....	1	1	2	San Salvador.....	2	1	3
Ecuador.....	.....	4	4	St. Kitts.....	3	5	8
England.....	.....	11	11	St. Lucia.....	10	43	53
Fortune Islands....	12	2	14	St. Thomas.....	1	5	6
France.....	1	10	11	St. Vincent.....	9	7	16
Germany.....	1	2	3	Spain.....	54	56	110
Greece.....	5	4	9	Syria.....	.....	2	2
Grenada.....	12	14	26	Switzerland.....	.....	2	2
Guadeloupe.....	6	15	21	Trinidad.....	12	16	28
Guiana, British....	2	1	3	Turks Island.....	1	2	3
Haiti.....	2	4	6	United States.....	35	51	86
Holland.....	1	.....	1	Venezuela.....	.....	7	7
Honduras.....	1	.....	1	West Indies.....	1	1	2
India.....	4	1	5	Unknown.....	.....	11	11
Ireland.....	.....	1	1				
Italy.....	5	10	15	Total.....	508	2,655	3,163

Causes of deaths of employees of the Isthmian Canal Commission and Panama R. R.

Causes of death.	White.	Colored.	Total.	Causes of death.	White.	Colored.	Total.
DISEASE.				DISEASE—continued.			
Alcoholism, acute and chronic.....	2	.....	2	Other forms of mental alienation.....	.....	1	1
Anemia.....	.....	1	1	Other diseases of the nervous system.....	.....	1	1
Aneurysm.....	1	3	4	Pericarditis.....	.....	2	2
Angina pectoris.....	.....	1	1	Phlebitis.....	.....	1	1
Apoplexy.....	1	3	4	Peritonitis, simple.....	.....	1	1
Appendicitis.....	1	.....	1	Pleurisy.....	.....	2	2
Brain, softening of.....	2	2	4	Pneumonia.....	.....	6	6
Cancer and other malignant tumors:				Lobar.....	7	69	76
Of buccal cavity.....	1	.....	1	Pupura hemorrhagica.....	.....	1	1
Of stomach and liver.....	.....	3	3	Pyemia.....	2	5	7
Of organs not specified.....	1	2	3	Pyemia and septicemia, pneumococcic.....	.....	4	4
Dysentery.....	1	1	2	Septicemia.....	1	.....	1
Amebic.....	1	2	3	Purulent infection and.....	1	5	6
Clinical.....	.....	9	9	Spleen, disease of.....	.....	1	1
Embolism and thrombosis.....	.....	2	2	Stomach, disease of.....	.....	1	1
Empyema.....	1	1	2	Stricture of urethra.....	.....	1	1
Encephalitis.....	.....	1	1	Syphilis.....	.....	2	2
Endocarditis, acute.....	.....	1	1	Tetanus.....	.....	1	1
Fever:				Tuberculosis:			
Hemoglobinuric.....	14	1	15	Abdominal.....	.....	2	2
Malaria.....	.....	1	1	Disseminated.....	.....	21	21
Malaria, cachexia.....	.....	1	1	Miliary.....	.....	5	5
Malaria, estivo autumnal.....	10	9	19	Pulmonary.....	1	25	26
Typhoid.....	2	6	8	Ulcer:			
Heart, organic disease of.....	3	14	17	Duodenal.....	.....	2	2
Hemorrhages other.....	.....	1	1	Of the stomach.....	.....	1	1
Hernia, strangulated.....	.....	1	1	Undiagnosed.....	.....	1	1
Infection of undetermined origin.....	1	3	4	VIOLENCE.			
Liver:				Absorption of deleterious gases.....	1	1	2
Abscess of.....	4	3	7	Accidental traumatisms, various.....	8	24	32
Cirrhosis of.....	1	2	3	Burns and scalds.....	.....	3	3
Disease of.....	.....	1	1	Drowning, accidental.....	6	15	21
Lungs:				Dynamite explosions.....	6	12	18
Abscess of.....	.....	2	2	Electric shock.....	2	1	3
Gangrene of.....	3	3	6	Homicides.....	2	3	5
Measles.....	.....	2	2	Injuries by animals.....	.....	1	1
Meningitis:				Lightning.....	.....	2	2
Pneumococcus.....	.....	5	5	Poisonings, acute.....	.....	1	1
Tuberculous.....	.....	1	1	Railroad accidents.....	17	40	57
Simple.....	1	4	5	Suicides.....	3	3	6
Nephritis:				Other external violence..	1	2	3
Acute.....	1	3	4	Total.....			
Chronic.....	4	28	32		114	394	508
Other diseases of the digestive system.....	1	.....	1				
Other diseases of the kidneys and annexa.....	.....	2	2				

Deaths of white employees from the United States.

Name.	Division.	Time on Isthmus.	Age.	Cause of death.
<i>July, 1911.</i>				
Brown, John F.....	Transportation.....	2 years, 11 months.	55	Railroad traumatism.
Elsey, John T.....	Atlantic division.....	5 years....	38	Hemoglobinuric fever.
Penny, H. H.....	Central division.....	6 years....	65	Acute alcoholism.
<i>August, 1911.</i>				
Blair, J. C.....	Pacific division.....	1½ years....	45	Traumatism by fall.
Caldwell, G. A.....	Department of sanitation.	7½ years....	46	Abscess of liver.
McArthur, Semore....	Mechanical division...	5 years....	49	Chronic nephritis.
<i>September, 1911.</i>				
Alton, Steven M.....	Civil administration...	14 months.	41	Septicemia.
Clayton, W. E.....	Atlantic division.....	4 years....	45	Disease of the digestive system.
Coe, Henry P.....	do.....	9 months..	49	Hemoglobinuric fever.
<i>October, 1911.</i>				
West, C. B.....	Central division.....	6 years....	44	Chronic nephritis.
<i>November, 1911.</i>				
Benion, H. G.....	Mechanical division...	1 year, 4 months.	32	Malaria fever, estivo-autumnal.
McEvers, Edward.....	do.....	2 years....	43	Traumatism by machines.
Turrell, Joseph.....	Municipal engineering division.	5 years....	37	Suicide by cutting instrument.
<i>December, 1911.</i>				
Des Londes, Oscar.....	Panama Railroad Co..	2 years....	34	Electric shock.
Treadwell, Edward F..	Pacific division.....	7 months..	24	Traumatism in mines and quarries.
Wallendorf, Joseph....	Central division.....	7 years....	40	Hepatic abscess (amebic).
<i>January, 1912.</i>				
Grigsby, Frank C.....	Central division.....	4 years....	46	Heart failure.
Guillon, Felix.....	Panama Railroad Co..	6 years....	32	Softening of the brain.
Horam, J. L.....	Civil administration...	2½ years....	23	Malaria fever, estivo-autumnal.
<i>February, 1912.</i>				
Cole, S. C.....	Central division.....	5 years....	54	Simple meningitis.
Colip, E. H.....	Panama Railroad Co..	7 years....	51	Abscess of the liver.
Ferguson, Howard.....	Quartermaster's department.	2 weeks....	60	Acute nephritis.
<i>March, 1912.</i>				
Hagan, John.....	Panama Railroad Co..	7 years....	45	Appendicitis.
Kornfeld, Karl.....	Atlantic division.....	2 years....	42	Organic disease of heart.
Longtin, F. R.....	Pacific division.....	.....	29	Railroad traumatism.
Sadler, Joseph V.....	Central division.....	5½ years....	50	Do.
<i>April, 1912.</i>				
Kenison, Nelson.....	Mechanical division...	4 years....	60	Traumatism by machines.
<i>May, 1912.</i>				
Golden, John P.....	Pacific division.....	3 years, 9 months.	34	Traumatism in mines and quarries.
Gould, Charles R.....	Civil administration...	7 months..	32	Suicide by firearms.
Higley, Charles.....	Atlantic division.....	3½ years....	43	Absorption of deleterious gases.
Kemp, John D.....	Civil administration...	7 months..	26	Accidental drowning.
Mahoney, Martin.....	McClintic-Marshall Co.	1 year....	42	Traumatism by fall.
<i>June, 1912.</i>				
Brenner, Joseph B.....	Panama R. R. commissary.	4 years....	38	Accidental drowning.
Powers, Ike.....	Pacific division.....	6 years....	56	Hemoglobinuric fever.
Schwartz, Henry.....	Mechanical division...	7 years....	46	Amebic abscess of liver.

Deaths of white women and children from the United States.

Name.	Time on Isthmus.	Age.	Cause of death.
<i>July, 1911.</i>			
Drake, Grace Pearl.....	2 years.....	30 years.....	Malaria fever, estivo-autumnal.
Flemming, Harry William...	8 months.....	8 months.....	Simple meningitis.
Kelly, Hannah.....	13 months.....	1 year, 1 month...	Acute dysentery.
Otis, Amelia.....	1 year.....	59 years.....	Malaria fever, estivo-autumnal.
Verner, Robert.....	18 months.....	1½ years.....	Laryngeal diphtheria.
<i>August, 1911.</i>			
Denst, Frank.....	.....	2 years.....	Burns by hot water.
Sominers, Frederick.....	2 months.....	2 months.....	Malnutrition.
Swain, John.....	20 days.....	20 days.....	Broncho-pneumonia.
<i>September, 1911.</i>			
Boyd, Elizabeth M.....	6 years.....	32 years.....	Carcinoma, disseminated.
Fenstermacher, Jack Edwin...	4 days.....	4 days.....	Intestinal obstruction.
Grier, Robert.....	2 years.....	4½ years.....	Accidental drowning.
Johnson, Phyllis Travella...	4 months.....	4 months.....	Meningitis.
Pickett (infant).....	2 days.....	2 days.....	Meningeal hemorrhage.
Thompson, Margaret.....	.....	5 years.....	Malaria fever, estivo-autumnal.
<i>October, 1911.</i>			
Nigg, Mary.....	15 months.....	14 years.....	General peritonitis.
<i>November, 1911.</i>			
Cecil, Mrs. H. E.....	18 months.....	44 years.....	Carcinoma of gall bladder.
Gelme (infant).....	1 day.....	1 day.....	Premature birth.
<i>December, 1911.</i>			
Hollin, Ivy Violet.....	15 months.....	15 months.....	Disease of lymphatic system.
<i>January, 1912.</i>			
Briggs (infant).....	6 hours.....	6 hours.....	Premature birth.
Todt, Mrs. F. M.....	3 years.....	40 years.....	Acute nephritis.
<i>February, 1912.</i>			
Sanders, Velma Lee.....	6 months.....	6 months.....	Pertussis.
<i>March, 1912.</i>			
Davis (infant).....	9 hours.....	9 hours.....	Premature birth.
Rossener (infant).....	15 days.....	15 days.....	Broncho-pneumonia.
<i>April, 1912.</i>			
Peterson, Mabel.....	6 months.....	6 months.....	Malaria fever, estivo-autumnal.
<i>May, 1912.</i>			
Einermann, Dorothy.....	5 months.....	63 years.....	Organic heart disease.
Henter, John.....	8 months.....	8 months.....	Gastro enteritis.
Keeling, Mrs. James R.....	5 years.....	35 years.....	Acute meningitis.
McLaughlin, Richard.....	2½ years.....	2½ years.....	Malaria fever, estivo-autumnal.
Roe, Mrs. Martin.....	6 years.....	35 years.....	Acute pelvic peritonitis.
Willet, Leon E.....	5 months.....	5 months.....	Diarrhea and enteritis.
<i>June, 1912.</i>			
Reynolds, Thomas.....	11 months.....	11 months.....	Diarrhea and enteritis.

Death rate among Americans on the Isthmus.

	Deaths from—			Annual average per 1,000 from—		
	Disease.	Violence.	All causes.	Disease.	Violence.	All causes.
White employees from United States (average number, 5,934).....	20	15	35	3.37	2.53	5.90
White women and children from United States (average number, 4,476).....	29	2	31	6.48	.45	6.93
White employees and their families from United States (average number, 10,410).....	49	17	66	4.71	1.63	6.34
Total Americans on Canal Zone (11,797) ¹ ..	31	17	48	3.48	1.95	5.43

¹ The figures representing the total number of Americans on the Canal Zone include employees and their families and the officers and men of the Tenth Infantry and Marines and their families. The deaths shown under this heading are for the last 9 months of the year only.

Causes and places of death of employees and civil population.

Diseases.	Ancon Hos- pital.	Colon Hos- pital.	Pan- ama.	Colon.	Zone.	Total.
<i>1. General diseases.</i>						
Typhoid fever.....	7	6				13
Malaria.....	2	1	92	12	70	177
Malarial fever:						
Estivo autumnal.....	35	16		1	19	71
Tertian.....		2		1	1	4
Cachexia.....			2		2	4
Hemoglobinuric fever.....	12	7	1		2	22
Measles.....	2		1			3
Whooping cough.....	1		1		1	3
Diphtheria and croup.....	4		5			9
Influenza.....			2			2
Cholera nostras.....		1	1			1
Dysentery.....		1	21	5	6	33
Amœbic.....	5	2	1		1	9
Clinical.....	12				1	13
Erysipelas.....	1		3			4
Yaws.....			2			2
Purulent infection and septicemia.....	9					9
Pyemia.....	8	1	2			11
Septicemia.....	1	7	11	1		20
Pyemia and septicemia, pneumococcic.....	7	1				8
Tetanus.....	1	3	6	1		11
Pellagra.....	1	7	6	1		15
Beriberi.....		1	35			36
Tuberculosis of the lungs.....	50	25	162	25	31	293
Acute miliary tuberculosis.....	9	4		1	1	15
Tuberculous meningitis.....	1	1			1	3
Abdominal tuberculosis.....	3	3	4			10
Pott's disease.....			1			1
Tuberculosis of the larynx.....				1		1
Tuberculous abscess.....					1	1
Tuberculosis of other organs.....	1	2				3
Disseminated tuberculosis.....	45	4	2		1	52
Rickets.....			2			2
Syphilis.....		2	7		1	10
Tertiary.....	1	1	1		1	4
Hereditary.....		2	4		2	8
Gonorrheal arthritis.....	1					1
Cancer and other malignant tumors:						
Buccal cavity.....	1		1	1		3
Stomach and liver.....	9	3	1		2	15
Female genital organs.....	2	2	6		1	11
Breast.....		1	1			2
Skin.....	1					1
Other organs and of organs not specified.....	5	2	5		1	13
Tumor of brain.....	1					1
Other tumors (tumors of the female genital organs excepted).....			1			1
Acute articular rheumatism.....			3	1		4
Chronic rheumatism and gout.....			1			1
Diabetes.....		1				1
Anemia:						
Chlorosis.....	3					3
Primary, pernicious.....	2			2	3	7

Causes and places of death of employees and civil population—Continued.

Diseases.	Ancon Hos- pital.	Colon Hos- pital.	Pan- ama.	Colon.	Zone.	Total.
<i>I. General diseases.</i>						
Alcoholism:						
Acute or chronic.....	2	1	14	1	2	20
Acute.....	1		3		1	5
Alcoholic psychosis.....	3					3
<i>II. Diseases of the nervous system and of the organs of special sense.</i>						
Encephalitis.....	1	1	2			4
Simple meningitis.....	4	3	15	3	7	32
Pneumococcus meningitis.....	9	4				13
Acute anterior polio myelitis.....		1			1	2
Cerebral hemorrhage, apoplexy.....	3	5	15	4	12	39
Softening of the brain.....	4	2			1	7
Paralysis without specified cause.....			8	1	1	10
Other forms of mental alienation.....	3					3
Epilepsy.....			3	1	4	8
Convulsions:						
Nonpuerperal.....			3		1	4
Of infants.....				7	9	16
Neuritis.....	1		1			2
Neurasthenia.....			1			1
Other diseases of the nervous system.....	1	1			1	3
<i>III. Diseases of the circulatory system.</i>						
Pericarditis.....	2			1		3
Acute endocarditis.....		3	34			37
Malignant endocarditis.....			1			1
Organic diseases of the heart.....	20	5	38	4	16	83
Angina pectoris.....			2		2	4
Aneurism.....	4	2	3	1	1	11
Arterio-sclerosis.....	1		11		2	14
Embolism, thrombosis.....	1	2	1		1	5
Phlebitis.....	1					1
Other diseases of the lymphatic system.....	1					1
Pupura hemorrhagica.....		1				1
Other hemorrhages: Other diseases of the circulatory system.....		1	6	1	10	18
<i>IV. Diseases of the respiratory system.</i>						
Laryngitis.....	1					1
Other diseases of the larynx.....		2		1		3
Diseases of the thyroid body.....					1	1
Acute bronchitis.....			41	15	6	62
Chronic bronchitis.....			6	2		8
Broncho-pneumonia.....	13	5	23	14	38	93
Pneumonia (unqualified).....		1	63	9	21	94
Lobar pneumonia.....	70	18	5	1	13	107
Pleurisy.....	2		1	3		6
Empyema.....	2	1				3
Pulmonary congestion, pulmonary apoplexy.....			13	1		14
Gangrene of the lungs.....	7	2				9
Asthma.....			3	2	1	6
Pulmonary emphysema.....			1	1		2
Abscess of lungs.....	1	2				3
Other diseases of the respiratory system (tuberculosis ex- cepted).....				1		1
<i>V. Diseases of the digestive system.</i>						
Stomatitis.....				1	6	7
Other diseases of the mouth and adnexa.....			1			1
Ulcer of the stomach.....	1		1	1		3
Acute gastritis.....			1	5	3	9
Chronic gastritis.....				1		1
Acute indigestion.....			1	2	1	4
Other diseases of the stomach (cancer excepted).....		1	1			2
Diarrhea and enteritis:						
Under 2 years.....	14	10	237	30	64	355
Two years and over.....	4	1	29	2	3	39
Ankylostomiasis.....					1	1
Ascariasis.....					2	2
Other intestinal parasites.....			14		1	15
Appendicitis and typhlitis.....		2	2			4
Hernias, intestinal obstructions.....	2	1	5			8
Intestinal obstruction.....	2		5		2	9
Other diseases of the intestines.....	1	2	3		2	8
Duodenal ulcer.....	2					1
Acute yellow atrophy of the liver.....					1	2
Cirrhosis of the liver.....	3	1	14	2	3	23
Abscess of liver (unqualified).....		4	3			7

Causes and places of death of employees and civil population—Continued.

Diseases.	Ancon Hos- pital.	Colon Hos- pital.	Pan- ama.	Colon.	Zone.	Total.
<i>V. Diseases of the digestive system—Continued.</i>						
Amebic abscess of the liver.....	8	3	.....	.....	.....	11
Cholecystitis.....	.....	1	1	.....	.....	2
Jaundice.....	.....	.....	1	.....	1	2
Other diseases of the liver.....	1	.....	4	2	.....	7
Other diseases of the spleen.....	.....	1	.....	.....	1	2
Simple peritonitis (nonpuerperal).....	4	5	1	3	3	16
Other diseases of the digestive system (cancer and tubercu- losis excepted).....	2	1	.....	.....	1	4
<i>VI. Nonvenereal diseases of the genito-urinary system and annexa.</i>						
Acute nephritis.....	3	9	18	5	9	44
Bright's disease (chronic nephritis).....	43	27	53	13	10	146
Pyelo-nephrosis.....	1	3	.....	.....	.....	4
Other diseases of the kidney and annexa.....	6	1	1	.....	.....	8
Cystitis.....	.....	.....	.....	1	1	2
Stricture of the urethra.....	1	.....	.....	.....	.....	1
Vesico-vaginal fistula.....	.....	.....	2	.....	.....	2
Other diseases of the urethra, urinary abscess, etc.....	1	.....	1	.....	.....	2
Chronic prostatitis.....	.....	.....	1	.....	.....	1
Hypertrophy of prostate.....	.....	.....	1	.....	.....	1
Other diseases of the prostate.....	.....	.....	1	.....	.....	1
Hydrocele.....	.....	.....	1	.....	.....	1
Other nonvenereal diseases of the male genital organs.....	.....	.....	2	.....	.....	2
Uterine tumor (noncancerous).....	.....	.....	1	.....	.....	1
Other diseases of the uterus.....	.....	.....	1	.....	.....	1
Cysts and other tumors of the ovaries.....	.....	.....	.....	.....	1	1
Salpingitis and other diseases of the female genital organs.....	.....	.....	1	.....	.....	1
<i>VII. The puerperal state.</i>						
Accidents of pregnancy.....	.....	1	.....	.....	.....	1
Abortion.....	.....	1	1	.....	.....	2
Puerperal hemorrhage.....	.....	.....	.....	1	1	2
Accidents of labor, other.....	1	.....	2	.....	1	4
Puerperal septicemia.....	2	1	4	2	2	11
Eclampsia.....	2	4	3	2	4	15
Following childbirth (not otherwise defined).....	.....	.....	.....	.....	2	2
<i>VIII. Diseases of the skin and of the cellular tissue.</i>						
Gangrene.....	1	1	1	.....	1	4
Elephantiasis.....	.....	.....	1	.....	.....	1
<i>X. Malformations.</i>						
Congenital malformations (stillbirth not included).....	.....	.....	1	.....	.....	1
<i>XI. Diseases of early infancy.</i>						
Congenital debility, icterus, and sclerema.....	3	4	7	16	33	63
Premature birth.....	10	11	19	2	28	70
Other diseases peculiar to early infancy.....	3	5	6	11	18	43
Malnutrition.....	5	4	17	21	99	146
Lack of care.....	.....	.....	.....	.....	1	1
Accidents at birth.....	.....	.....	.....	2	1	3
<i>XII. Old age.</i>						
Senility.....	1	.....	7	3	12	23
<i>XIII. Affections produced by external causes.</i>						
Suicide:						
Poisoning.....	.....	.....	2	.....	1	3
Hanging or strangulation.....	.....	.....	2	.....	1	3
Drowning.....	.....	.....	.....	.....	4	4
Firearms.....	.....	1	2	1	6	10
Cutting or piercing instruments.....	.....	1	.....	.....	1	2
Other acute poisonings.....	.....	2	.....	.....	1	3
Burns (conflagration excepted).....	3	2	1	.....	2	8
Absorption of deleterious gases (conflagration excepted).....	2	.....	.....	.....	.....	2
Accidental drowning.....	.....	.....	2	5	32	39
Traumatism:						
Firearms.....	.....	.....	3	.....	1	4
Cutting or piercing instruments.....	1	1	.....	.....	.....	2
Fall.....	6	6	3	1	6	22
Mines and quarries.....	6	.....	.....	.....	13	19
Machines.....	3	2	.....	1	3	9
Other crushings (vehicles, railroads, landslides, etc.).....	25	11	1	1	43	81

Causes and places of death of employees and civil population—Continued.

Diseases.	Ancon Hos- pital.	Colon Hos- pital.	Pan- ama.	Colon.	Zone.	Total.
XIII. Affections produced by external causes—Continued.						
Injuries by animals.....	1					1
Starvation.....			2			2
Lightning.....					2	2
Electricity (lightning excepted).....					3	3
Homicide:						
Firearms.....			3		2	5
Cutting or piercing instruments.....	2	2	2	1	1	8
Other means.....	1			1	1	3
Fractures (cause not specified).....			1		1	2
Other external violence.....		3			1	4
XIV. Ill-defined diseases.						
Ill-defined organic diseases.....	2				2	5
Cause of death not specified or ill-defined.....	8	1	21	5	3	38
Infections of undetermined origin.....	8	2	1		1	12
Total.....	596	310	1,235	271	751	3,163
Stillbirths.....	4	14	154	61	103	336
Grand total.....	600	324	1,389	332	854	3,499

NOTE.—The deaths occurring in Ancon and Colon Hospitals resulting from illness, injury, or other cases admitted from the cities of Panama and Colon or from the Canal Zone are in the table of vital statistics credited to the places from whence they were admitted.

Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission, from all causes, for the fiscal year 1911-12.

Diseases.	Dis- charged.	Died.
I. General diseases.		
Typhoid fever.....	40	7
Relapsing fever.....	2	
Malaria.....	1	
Malaria fever:		
Estivo autumnal.....	3,981	17
Tertian.....	770	
Quartan.....	73	
Mixed.....	19	
Undetermined.....	10	
Clinical.....	2,173	1
Cachexia.....	15	
Hemoglobinuric fever.....	61	14
Vaccinia.....	16	
Measles.....	54	2
Scarlet fever.....	1	
Diphtheria and croup.....	33	
Influenza.....	133	
Dysentery.....	2	
Amebic.....	31	3
Bacillary.....	1	
Clinical.....	108	9
Leprosy.....	2	
Erysipelas.....	5	
Chicken pox.....	17	
Mumps.....	76	
Yaws.....	4	
Acute infectious jaundice (Weil's disease).....	3	
Other epidemic diseases.....	5	
Purulent infection and septicemia.....	15	8
Pyemia.....	1	6
Septicemia.....	1	
Pyemia and septicemia, pneumococcic.....		4
Tetanus.....	3	1
Pellagra.....	8	
Tuberculosis of the lungs.....	132	26
Acute miliary tuberculosis.....		5
Tuberculous meningitis.....		1
Abdominal tuberculosis.....	11	2
Pott's disease.....	7	

Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission, from all causes, for the fiscal year 1911-12—Continued.

Diseases.	Dis- charged.	Died.
<i>I. General diseases—Continued.</i>		
Tuberculosis:		
Bones and joints.....	10	.....
Skin.....	3	.....
Lymph glands.....	7	.....
Genito-urinary organs.....	6	.....
Other organs.....	3	.....
Disseminated tuberculosis.....	6	22
Syphilis:		
Primary.....	22	.....
Secondary.....	194	.....
Tertiary.....	125	1
Hereditary.....	1	.....
Period not stated.....	86	.....
Soft chancre.....	236	.....
Adenitis chancreoid.....	402	.....
Gonococcus infection.....	153	.....
Gonorrhea.....	311	.....
Gonorrheal arthritis.....	20	.....
Gonorrheal ophthalmia.....	9	.....
Cancer and other malignant tumors:		
Buccal cavity.....	2	1
Stomach and liver.....	6	3
Peritoneum, intestines, rectum.....	3	.....
Skin.....	1	.....
Other organs and of organs not specified.....	4	3
Tumor of brain.....	1	.....
Other tumors (tumors of the female genital organs excepted).....	42	.....
Acute articular rheumatism.....	28	.....
Chronic rheumatism and gout.....	9	.....
Gout.....	1	.....
Arthritis deformans.....	4	.....
Muscular rheumatism.....	80	.....
Diabetes.....	5	.....
Anemia:		
Chlorosis.....	32	1
Primary, pernicious.....	4	.....
Other general diseases.....	3	.....
Alcoholism:		
Acute or chronic.....	34	1
Acute.....	67	1
Alcoholic psychosis.....	9	.....
Other chronic occupational poisonings.....	2	.....
Other chronic poisonings.....	1	.....
<i>II. Diseases of the nervous system and of the organs of special sense.</i>		
Simple meningitis.....	.....	4
Pneumococcus meningitis.....	.....	5
Locomotor ataxia.....	1	.....
Acute anterior polio-myelitis.....	1	.....
Other diseases of the spinal cord.....	2	1
Cerebral hemorrhage, apoplexy.....	7	4
Softening of the brain.....	.....	4
Paralysis without specified cause.....	16	.....
Other forms of mental alienation.....	44	1
Epilepsy.....	19	.....
Hysteria.....	18	.....
Neuralgia.....	37	.....
Neuritis.....	82	.....
Neurasthenia.....	218	.....
Other diseases of the nervous system.....	27	1
Follicular conjunctivitis.....	45	.....
Trachoma.....	5	.....
Other diseases of the eye and its annexa.....	619	.....
Diseases of the ear.....	216	.....
<i>III. Diseases of the circulatory system.</i>		
Pericarditis.....	2	2
Acute endocarditis.....	6	1
Organic disease of the heart.....	56	11
Aneurism.....	5	3
Arterio-sclerosis.....	12	.....
Other diseases of the arteries.....	1	.....
Embolism, thrombosis.....	.....	2
Hemorrhoids.....	119	.....
Varices.....	13	.....
Varicocele.....	56	.....
Phlebitis.....	5	1
Other diseases of the veins.....	8	.....
Oymph adenitis (nonvenereal).....	116	1
Other diseases of the lymphatic system.....	84	.....
Other hemorrhages; other diseases of the circulatory system.....	5	1

Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission, from all causes, for the fiscal year 1911-12—Continued.

Diseases.	Dis- charged.	Died.
<i>IV. Diseases of the respiratory system.</i>		
Adenoid vegetations.....	3	.....
Inflammation of accessory nasal sinuses.....	64	.....
Other diseases of nasal fossæ.....	235	.....
Laryngitis.....	14	.....
Other diseases of the larynx.....	6	.....
Diseases of the thyroid body.....	3	.....
Acute bronchitis.....	299	.....
Chronic bronchitis.....	68	.....
Broncho-pneumonia.....	13	3
Lobar pneumonia.....	278	75
Pleurisy.....	123	2
Empyema.....	8	2
Gangrene of the lungs.....	1	6
Asthma.....	30	.....
Pulmonary emphysema.....	5	.....
Abscess of lungs.....	.....	1
Other diseases of the respiratory system (tuberculosis excepted).....	10	2
<i>V. Diseases of the digestive system.</i>		
Diseases of the teeth and gums.....	20	.....
Stomatitis.....	6	.....
Other diseases of the mouth and annexa.....	40	.....
Pharyngitis.....	84	.....
Follicular tonsillitis.....	250	.....
Other diseases of the pharynx.....	27	.....
Foreign body in the œsophagus.....	1	.....
Stricture of the œsophagus.....	1	.....
Other diseases of the œsophagus.....	1	.....
Ulcer of the stomach.....	18	1
Gastrectasis.....	1	.....
Acute gastritis.....	27	.....
Chronic gastritis.....	117	.....
Acute indigestion.....	145	.....
Other diseases of the stomach (cancer excepted).....	78	1
Diarrhea and enteritis (2 years and over).....	228	.....
Ankylostomiasis.....	49	.....
Ascariasis.....	3	.....
Tapeworm.....	2	.....
Strongyloides.....	2	.....
Other intestinal parasites.....	21	.....
Appendicitis and typhlitis.....	155	1
Hernias, intestinal obstructions.....	32	1
Inguinal hernia.....	260	.....
Other hernias.....	19	.....
Intestinal obstruction.....	3	.....
Diseases of the anus and fecal fistulas.....	35	.....
Other diseases of the intestines.....	118	.....
Duodenal ulcer.....	8	2
Cirrhosis of the liver.....	21	2
Biliary calculi.....	2	.....
Abscess of liver (unqualified).....	8	1
Amœbic abscess of the liver.....	5	6
Cholecystitis.....	11	.....
Jaundice.....	19	.....
Other diseases of the liver.....	8	1
Other diseases of the spleen.....	8	1
Other diseases of the digestive system (cancer and tuberculosis excepted).....	6	1
Simple peritonitis (nonpuerperal).....	12	1
<i>VI. Nonvenereal diseases of the genito-urinary system and annexa.</i>		
Acute nephritis.....	15	2
Bright's disease (chronic nephritis).....	101	30
Movable kidney.....	1	.....
Pyelo-nephrosis.....	4	.....
Other diseases of the kidney and annexa.....	17	2
Calculi of the urinary passages.....	16	.....
Diseases of the bladder.....	2	.....
Cystitis.....	30	.....
Stricture of the urethra.....	63	1
Other diseases of the urethra, urinary abscess, etc.....	49	.....
Acute prostatitis.....	3	.....
Chronic prostatitis.....	2	.....
Abscess of the prostate.....	2	.....
Other diseases of the prostate.....	1	.....
Hydrocele.....	76	.....
Chylocele.....	6	.....
Other nonvenereal diseases of the male genital organs.....	135	.....
Uterine tumor (noncancerous).....	3	.....
Metritis.....	3	.....
Other diseases of the uterus.....	4	.....
Cysts and other tumors of the ovaries.....	1	.....
Salpingitis and other diseases of the female genital organs.....	3	.....
Nonpuerperal diseases of the breast (cancer excepted).....	2	.....

Table showing discharges and deaths of employees in the hospitals of the Isthmian Canal Commission, from all causes, for the fiscal year 1911-12—Continued.

Diseases.	Dis- charged.	Died.
VII. The puerperal state.		
Normal labor.....	1	.....
Hyperemesis gravidarum.....	1	.....
Abortion.....	1	.....
VIII. Diseases of the skin and of the cellular tissue.		
Gangrene.....	2	.....
Furuncle.....	120	.....
Carbuncle.....	15	.....
Acute abscess.....	276	.....
Phlegmon.....	50	.....
Scabies.....	3	.....
Other diseases of the skin and annexa.....	405	.....
Red bug.....	2	.....
Pemphigus contagiosus.....	1	.....
Filaria medinensis.....	1	.....
Elephantiasis.....	16	.....
Dhobie itch.....	33	.....
Ulcer of the skin.....	164	1
Tropical ulcer.....	9	.....
Ainhum.....	1	.....
Impetigo contagiosa.....	4	.....
Urticaria.....	4	.....
IX. Diseases of the bones and of the organs of locomotion.		
Caries (nontuberculous).....	4	.....
Mastoid abscess.....	2	.....
Osteomyelitis.....	12	.....
Periostitis.....	32	.....
Other diseases of the bones (tuberculosis excepted).....	19	.....
Ankylosis.....	7	.....
Arthritis.....	84	.....
Synovitis.....	43	.....
Other diseases of the joints (tuberculosis and rheumatism excepted).....	45	.....
Amputations.....	79	.....
Other diseases of the organs of locomotion.....	180	.....
X. Malformations.		
Congenital malformations (stillbirth not included).....	7	.....
XI. Old age.		
Senility.....	6	.....
XII. Affections produced by external causes.		
Poisoning by food.....	18	.....
Venomous bites and stings.....	3	.....
Other acute poisonings.....	2	1
Burns (conflagration excepted).....	149	1
Absorption of deleterious gases (conflagration excepted).....	.....	1
Traumatism;		
Firearms.....	16	.....
Cutting or piercing instruments.....	492	1
Fall.....	163	6
Mines and quarries.....	2,089	6
Machines.....	196	1
Other crushings (vehicles, railroads, landslides, etc.).....	566	38
Injuries by animals.....	1	1
Overexertion.....	1	.....
Effects of heat.....	3	.....
Heat exhaustion.....	1	.....
Lightning.....	2	.....
Electricity (lightning excepted).....	7	.....
Homicide by cutting or piercing instruments.....	.....	1
Dislocations.....	30	.....
Sprains.....	258	.....
Fractures (cause not specified).....	459	.....
Other external violence.....	188	.....
XIII. Ill-defined diseases.		
Ill-defined organic diseases.....	7	.....
Cause of death not specified or ill defined.....	19	2
No disease, feigned disease.....	52	.....
Infections of undetermined origin.....	34	4
Total.....	21,529	390

Consolidated hospital report.

Hospitals.	Remain- ing July 1.		Admitted.		Died.		Discharged.		Trans- ferred.		Remain- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Ancon Hospital:												
Employees.....	359	613	7,432	9,387	60	232	5,390	9,223	2,075	79	266	466
Nonemployees.....	92	82	2,600	1,779	57	218	2,396	1,503	133	51	106	89
Insane.....	34	305	21	194	.....	28	14	136	16	74	25	261
Total.....	485	1,000	10,053	11,360	117	478	7,800	10,862	2,224	204	397	816
Colon Hospital:												
Employees.....	129	129	3,174	1,628	26	70	2,448	1,586	736	22	93	79
Nonemployees.....	40	77	1,215	1,451	37	178	1,145	1,265	28	14	45	71
Total.....	169	206	4,389	3,079	63	248	3,593	2,851	764	36	138	150
Culebra Hospital:												
Employees.....	.....	.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....
Nonemployees.....	1	8	65	226	1	6	62	208	3	14	.....	6
Total.....	1	8	66	226	1	6	63	208	3	14	.....	6
Palo Seco Leper Asylum:												
Employees.....	.....	.....	1	1	.....	.....	1	.....	.....	.....	.....	1
Nonemployees.....	1	43	1	10	.....	4	.....	2	.....	.....	2	47
Total.....	1	43	2	11	.....	4	1	2	.....	.....	2	48
Taboga Sanitarium:												
Employees.....	94	.....	2,874	.....	1	.....	2,893	.....	33	.....	41	.....
Nonemployees.....	2	.....	988	.....	.....	.....	969	.....	3	.....	18	.....
Total.....	96	.....	3,862	.....	1	.....	3,862	.....	36	.....	59	.....
Grand Total:												
Employees.....	582	742	13,482	11,016	87	302	10,733	10,809	2,844	101	400	546
Nonemployees.....	136	210	4,869	3,466	95	406	4,572	2,978	167	79	171	213
Insane.....	34	305	21	194	.....	28	14	136	16	74	25	261
Total.....	752	1,257	18,372	14,676	182	736	15,319	13,923	3,027	254	596	1,020

Consolidated sick-camp report.

Stations.	Remaining July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Miraflores.....	6	3	657	630	.....	.....	332	382	327	249	4	2
Pedro Miguel.....	11	6	331	525	.....	1	239	342	101	187	2	1
Paraiso.....	4	6	171	526	.....	.....	126	372	48	156	1	4
Culebra.....	7	13	539	961	3	.....	302	629	239	339	2	6
Empire.....	3	9	416	1,108	1	.....	322	758	95	355	1	4
Las Cascadas.....	10	5	508	479	1	3	429	409	85	71	3	1
Bas Obispo.....	2	10	325	537	.....	1	278	512	49	30	.....	4
Gorgona.....	.....	7	98	985	.....	.....	73	653	25	331	.....	8
Tabernilla.....	.....	.....	1	22	.....	.....	1	10	.....	12	.....	.....
Gatun.....	6	31	1,293	3,054	.....	1	845	1,969	449	1,101	5	14
Cristobal.....	3	9	183	1,260	.....	1	109	783	77	477	.....	8
Porto Bello.....	4	1	164	464	.....	.....	130	371	38	92	.....	2
Nombre de Dios.....	.....	2	1	41	.....	.....	.....	42	1	1	.....	.....
Toro Point.....	5	7	141	308	.....	.....	102	220	44	95	.....	.....
Total.....	61	109	4,828	10,900	5	7	3,288	7,452	1,578	3,496	18	54

Consolidated report of employees sick in quarters.

Stations.	Days excused for quarters.			New patients excused for quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Naos Island.....	7	36	43	3	25	28
Ancon.....	812	1,980	2,792	361	352	713
Balboa.....	729	78	807	323	57	380
Corozal.....	492	.....	492	330	.....	330
Miraflores.....	349	9	358	116	6	122
Pedro Miguel.....	762	17	779	338	13	351
Paraíso.....	728	.....	728	287	.....	287
Culcabra.....	715	58	773	329	33	362
Empire.....	2,212	7	2,219	985	3	988
Las Cascadas.....	718	.....	718	294	.....	294
Bas Obispo.....	336	3	339	148	1	149
Gorgona.....	3,682	.....	3,682	1,691	.....	1,691
San Pablo.....	52	1	53	17	1	18
Tabernilla.....	164	.....	164	61	.....	61
Gatun.....	1,439	60	1,499	726	2	728
Cristobal.....	2,121	429	2,550	1,071	109	1,180
Porto Bello.....	221	.....	221	127	.....	127
Nombre de Dios.....	2	.....	2	2	.....	2
Toro Point.....	126	.....	126	75	.....	75
Total.....	15,667	2,678	18,345	7,284	602	7,886

Consolidated hospital, sick camp, and sick-in-quarters report.

	Remain- ing July 1.		Admitted.		Died.		Discharged.		Trans- ferred.		Remain- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Hospitals.....	752	1,257	18,372	14,676	182	736	15,319	13,923	3,027	254	596	1,020
Sick camps.....	61	109	4,828	10,900	5	7	3,288	7,452	1,578	3,496	18	54
Total.....	813	1,366	23,200	25,576	187	743	18,607	21,375	4,605	3,750	614	1,074

	White.	Colored.	Total.
Total admissions to hospitals and sick camps.....	23,200	25,576	48,776
Number of employees sick in quarters.....	7,284	602	7,886
Total.....	30,484	26,178	56,662
Less number of patients transferred from sick camps to hospitals and from hospitals to sanitarium whose admissions are duplicated in above figures.....	4,605	3,750	8,355
Net admissions to hospitals and sick camps and those sick in quarters.....	25,879	22,428	48,307

Consolidated dispensary report.

Stations.	Employees.			Nonemployees.			Total.		
	White.	Colored.	Total.	White.	Colored.	Total.	White.	Colored.	Total.
Naos Island.....	128	905	1,033	.....	3	3	128	908	1,036
Ancon.....	7,414	16,073	23,487	3,829	4,440	8,269	11,243	20,513	31,756
Balboa.....	13,141	15,669	28,810	3,666	1,220	4,886	16,807	16,889	33,696
Corozal.....	9,408	6,307	15,715	2,883	792	3,675	12,291	7,099	19,390
Miraflores.....	19,667	21,432	41,099	430	672	1,102	20,097	22,104	42,201
Pedro Miguel.....	15,344	14,063	29,407	2,875	2,098	4,973	18,219	16,161	34,380
Paraíso.....	6,044	5,404	11,448	2,780	1,313	4,093	8,824	6,717	15,541
Culebra.....	25,358	26,928	52,286	11,085	11,737	22,822	36,443	38,665	75,108
Empire.....	22,049	31,151	53,200	11,401	9,097	20,498	33,450	40,248	73,698
Las Cascadas.....	9,283	7,923	17,206	5,220	3,753	8,973	14,503	11,676	26,179
Bas Obispo.....	17,621	14,929	32,550	3,967	2,214	6,181	21,588	17,143	38,731
Gorgona.....	22,710	22,802	45,512	6,087	5,601	11,688	28,797	28,403	57,200
San Pablo.....	1,289	1,820	3,109	1,007	1,448	2,455	2,296	3,268	5,564
Tabernilla.....	1,909	1,808	3,717	1,602	1,601	3,203	3,511	3,409	6,920
Gatun.....	42,938	42,935	85,873	4,730	3,361	8,091	47,668	46,296	93,964
Cristobal.....	16,484	20,179	36,663	7,123	3,586	10,709	23,607	23,765	47,372
Porto Bello.....	4,470	7,295	11,765	801	1,689	2,490	5,271	8,984	14,255
Nombre de Dios.....	422	1,016	1,438	5	156	161	427	1,172	1,599
Toro Point.....	5,737	8,497	14,234	358	518	876	6,095	9,015	15,110
Margarita Point.....	4	10	14	.....	.....	.....	4	10	14
Total.....	241,420	267,146	508,566	69,849	55,299	125,148	311,269	322,445	633,714

Average number of employees constantly sick in hospitals, sick camps, and quarters.

Hospitals.	White.	Colored.	Total.
Ancon Hospital.....	261.97	450.69	712.66
Colon Hospital.....	111.84	97.53	209.37
Culebra Hospital.....	.003	.....	.003
Palo Seco Leper Asylum.....	.25	.03	.28
Taboga Sanitarium.....	53.89	.....	53.89
Total.....	427.953	548.25	976.203

Stations.	Sick camps.			Sick in quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Bas Obispo.....	3.07	6.50	9.57	0.92	0.01	0.93
Naos Island.....	.....	.....	.....	.02	.10	.12
Ancon.....	.....	.....	.....	2.22	5.41	7.63
Balboa.....	.....	.....	.....	2.00	.21	2.21
Corozal.....	.....	.....	.....	1.34	.....	1.34
Miraflores.....	3.43	3.09	6.52	.95	.02	.97
Pedro Miguel.....	2.97	4.08	7.05	2.08	.05	2.13
Paraíso.....	1.43	4.00	5.43	1.99	.....	1.99
Culebra.....	4.08	7.74	11.82	1.95	.16	2.11
Empire.....	3.25	7.48	10.73	6.04	.02	6.06
Las Cascadas.....	5.96	6.07	12.03	1.96	.....	1.96
Gorgona.....	.71	6.76	7.47	10.06	.....	10.06
San Pablo.....	.....	.....	.....	.14	.003	.143
Tabernilla.....	.01	.11	.12	.45	.....	.45
Gatun.....	8.14	18.75	26.89	3.93	.16	4.09
Cristobal.....	1.11	8.33	9.44	5.79	1.17	6.96
Porto Bello.....	1.67	5.29	6.96	.60	.....	.60
Nombre de Dios.....	.003	.22	.223	.01	.....	.01
Toro Point.....	1.68	3.40	5.08	.34	.....	.34
Total.....	37.513	81.82	119.333	42.79	7.313	50.103

Average number of employees constantly sick.

	White.	Colored.	Total.
Hospitals.....	427.953	548.25	976.203
Sick camps.....	37.513	81.82	119.333
Sick in quarters.....	42.79	73.13	50.103
Total.....	508.256	637.383	1,145.639

Average number of employees constantly sick per 1,000.

	White.	Colored.	Total.
Hospitals.....	34.57	14.57	19.52
Sick camps.....	3.03	2.17	2.39
Sick in quarters.....	3.45	.19	1.00
Total.....	41.05	16.93	22.91

Average number of days' treatment per employee in hospitals, sick camps, and quarters.

Hospitals.	White.	Colored.	Total.
Ancon Hospital.....	12.74	17.30	15.29
Colon Hospital.....	12.75	21.27	15.68
Culebra Hospital.....	1.00	.....	1.00
Palo Seco Leper Asylum.....	92.00	11.00	51.50
Taboga Sanitarium.....	6.74	.....	6.74
Total.....	11.46	17.89	14.36

Stations.	Sick camps.			Quarters.		
	White.	Colored.	Total.	White.	Colored.	Total.
Naos Island.....	.....	.....	.....	2.33	1.44	1.54
Ancon.....	.....	.....	.....	2.25	5.62	3.92
Balboa.....	.....	.....	.....	2.26	1.37	2.12
Corozal.....	.....	.....	.....	1.49	.....	1.49
Miraflores.....	1.90	1.79	1.85	3.01	1.50	2.93
Pedro Miguel.....	3.19	2.82	2.96	2.25	1.31	2.22
Paraiso.....	3.00	2.77	2.83	2.54	.....	2.54
Culebra.....	2.74	2.93	2.86	2.17	1.76	2.14
Empire.....	2.85	2.46	2.57	2.25	2.33	2.25
Las Cascadas.....	4.24	4.60	4.41	2.44	.....	2.44
Bas Obispo.....	3.43	4.38	4.03	2.27	3.00	2.28
Gorgona.....	2.54	2.51	2.52	2.18	.....	2.18
San Pablo.....	.....	.....	.....	3.06	1.00	2.94
Tabernilla.....	2.00	1.91	1.91	2.69	.....	2.69
Gatun.....	2.30	2.23	2.25	1.98	3.00	2.06
Cristobal.....	2.18	2.42	2.39	1.98	3.94	2.16
Porto Bello.....	3.65	4.18	4.04	1.74	.....	1.74
Nombre de Dios.....	1.00	1.86	1.84	1.00	.....	1.00
Toro Point.....	4.21	3.95	4.03	1.68	.....	1.68
Total.....	2.82	2.73	2.76	2.15	4.45	2.33

Subsistence and operating expenses.

	Hospitals.	Sick camps.	Total.
SUBSISTENCE EXPENSES.			
Number of days' rations issued to patients.....	589, 107	43, 669	632, 776
Cost of rations issued to patients.....	\$149, 918. 59	\$10, 141. 39	\$160, 059. 98
Cost of subsistence per patient per day.....	\$0. 254	\$0. 232	\$0. 252
OPERATING EXPENSES.			
Number of days' relief furnished patients.....	598, 107	43, 669	632, 776
Cost of operation.....	\$718, 762. 03	\$20, 541. 83	\$739, 303. 86
Cost per capita per day.....	\$1. 22	\$0. 47	\$1. 17
Cost of operation with amount received from outside patients, etc., deducted.....	\$567, 411. 98	\$20, 541. 83	\$587, 953. 81
Cost per capita per day with above deduction.....	\$0. 96	\$0. 47	\$0. 93
Cost of dispensaries.....	\$160, 800. 07		

Outside patients treated in hospitals, and amounts collected for their treatment.

	Number of cases treated.	Number of days' relief.	Amount.
Patients for whom the Republic of Panama pays 75 cents per day..	2, 656	74, 378	\$55, 783. 50
Patients for whom the Canal Zone Government pays 30 cents per day.	497	13, 092	3, 927. 60
Patients paying 30 cents per day for themselves.....	2, 827	28, 084	8, 425. 20
Patients from the Republic of Panama paying other prices.....	1, 497	13, 886	30, 794. 59
Patients from the Canal Zone paying other prices.....	4, 187	33, 241	42, 780. 50
Patients from the Canal Zone not paying.....	2, 284	54, 244	
Patients from the Republic of Panama not paying.....	754	10, 332	
Total.....	14, 702	227, 257	141, 711. 39

NOTE.—Patients carried from one month to another are considered as separate cases in above table.

Surgical operations performed in hospitals.

	Number.	Died.		Number.	Died.
Amputations:			Genito-urinary tract:		
Shoulder.....	1		Nephrotomy.....	7	
Arm.....	8	1	Nephrectomy.....	2	
Forearm.....	3		Nephropexy.....	3	
Hand.....	1		Perinephritic abscess, drain- age of.....	2	
Hip joint.....	1		Ureterotomy.....	5	
Thigh.....	13	1	Cystotomy.....	2	
Leg.....	17		Urethrotomy—		
Foot.....	3		Internal.....	24	
Digits, multiple.....	53		External.....	60	1
Arm, double.....	1	1	Varicocele, radical cure.....	77	
Thigh, double.....	2	1	Hydrocele—		
Leg, double.....	1		Single, radical cure.....	74	
Arm and leg.....	1	1	Double, radical cure.....	24	
Operations on bones:			Orchidectomy.....	24	
Craniectomy—			Epididymotomy.....	66	
Decompressive.....	19	5	Vasectomy.....	3	
Exploratory.....	2		Amputation—		
Laminectomy.....	6	3	Scrotum.....	1	1
Osteotomy.....	30	1	Penis.....	2	
Resection of elbow.....	2		Curettage uteri.....	228	
Wiring of fractures—			Perineoplasty.....	41	
Simple.....	26		Trachelorrhaphy.....	23	
Compound.....	40		Vaginal sections.....	50	
Adenectomy:			Vaginal punctures.....	5	
Cervical.....	28	1	Obstetrical:		
Axillary.....	8		Cæsarian section—		
Inguinal—			Abdominal.....	3	1
Single.....	420		Vaginal.....	1	
Double.....	94		High forceps.....	9	
Femoral.....	37		Low forceps.....	33	
Herniotomy:			Version.....	8	
Inguinal—			Perineorrhaphy.....	73	
Single.....	210	1	Thorax:		
Double.....	140		Thoracotomy.....	15	2
Femoral.....	10		Pneumothoracotomy.....	5	2
Ventral.....	32		Excision—		
Combined (any two of the above).....	1		Breast.....	1	
Strangulated.....	8	2	Breast and axilla.....	6	

Surgical operations performed in hospital—Continued.

	Number.	Died.		Number.	Died.
Thorax—Continued.			Laparotomy—Continued.		
Gunshot wound of chest, operation for.....	1	.....	Appendectomy.....	221	.....
Stab wound of chest, operation for.....	3	.....	Appendectomy—		
Rectum:			With local peritonitis...	26	.....
Hemorrhoids, radical cure...	165	.....	With general peritonitis	13	2
Fistula in anus, excision of...	26	.....	Caecostomy.....	3	2
General:			Colostomy.....	2	.....
Excision of tongue.....	1	1	Sigmoidopexy.....	5	.....
Thyroidectomy.....	9	.....	Cholecystotomy.....	13	1
Aneurismorrhaphy.....	2	.....	Cholecystostomy.....	6	.....
Varicose veins, excision of...	26	.....	Cholecystectomy.....	2	.....
Tenorrhaphy.....	7	.....	Abscess of liver—		
Myorrhaphy.....	2	.....	Laparo-hepatotomy for...	13	8
Excision of surface neoplasms.....	22	.....	Thoraco-hepatotomy for...	23	5
Gunshot wound of soft parts, operation for.....	5	.....	Spleneectomy.....	2	.....
Stab wound of soft parts, operation for.....	2	.....	Pan-hystereectomy.....	14	.....
Extensive injuries to soft parts, operation for.....	1	.....	Supravaginal hystereectomy.....	20	.....
Plastic operation for—			Hysteromyomectomy.....	42	1
Congenital defect.....	4	.....	Myomectomy.....	13	.....
Severe injuries.....	40	.....	Salpingectomy—		
Effects of disease.....	38	.....	Single.....	14	.....
Skin graft.....	39	.....	Double.....	20	2
Laparotomy:			Salpingo-oophorectomy.....	24	1
For general peritonitis.....	14	7	Ovarian cystectomy.....	8	.....
For tuberculous peritonitis...	5	1	Suspensio-uteri.....	68	.....
For intestinal obstruction...	6	.....	Plastic operation for chronic pelvic peritonitis.....	70	1
Exploratory.....	42	3	For ectopic gestation.....	11	.....
Gastrotomy.....	3	1	For trauma:		
Gastro-enterostomy.....	12	1	General peritonitis.....	6	3
Entero-enterostomy.....	1	.....	Hematoperitoneum.....	1	.....
Enterectomy.....	2	1	Rupture of spleen.....	5	1
Enterorrhaphy.....	6	1	Stab wound of abdomen.....	1	1
			Major operations, various other.....	72	.....
			Minor operations, various.....	4,135	4
			Total.....	7,432	74

Operations and work performed in eye, ear, nose, and throat clinics.

	Number.		Number.
Abscess:		Incision and drainage:	
Alveolar.....	2	Abscess, retro-bulbar.....	1
Peritonsillar.....	1	Abscess eyelid.....	1
Adenectomy.....	123	Lacrimal sac.....	3
Adenectomy and tonsillectomy.....	1	Incision of chalazion.....	2
Advancement of external rectus.....	8	Incision of peritonsillar abscess.....	5
Advancement of internal rectus.....	5	Intubation.....	1
Amputation of uvula.....	2	Iridectomy.....	31
Blepharoplasty for ectropion (skin graft).....	1	Killian's operation—frontal sinus.....	1
Bowman's dilatation of lacrimal duct.....	2	Lacrimal canaliculus incised.....	3
Cataract:		Lacrimal duct probed.....	10
Discission of.....	7	Ligature conjunctival vessel.....	1
Needling.....	2	Mastoidectomy.....	22
Curetage ethmoid cells, left.....	2	Mastoidotomy:	
Cyst, sebaceous excision.....	1	Simple.....	7
Dilatation:		Radical.....	1
Lacrimal sac.....	9	Maxillary antrum, radical.....	1
Oesophageal.....	4	Maxillary sinus.....	3
Drainage of maxillary sinus.....	4	Ossiculectomy.....	1
Enneleation.....	3	Papillomatous growth eyelid resected.....	1
Evisceration.....	5	Paracentesis:	
Excision:		Cornea.....	9
Chalazion.....	15	Membrana tympani.....	12
Keloid.....	1	Paraffine prosthesis of nose.....	1
Lacrimal sac.....	2	Plastic on ear.....	3
Xanthoma of lids.....	1	Plastic on eyelid.....	24
Expression for follicular conjunctivitis.....	8	Plastic, face.....	3
Expression for trachoma.....	3	Plastic on nose.....	17
Extraction of cataract.....	22	Plastic closure, hard and soft palate.....	3
Goldsmith's plastic operation for closure septal perforation.....	1	Polyoid growth:	
Holsrath-Kuhnt operation.....	3	Tonsil removed.....	2
		Uvula removed.....	2

Operations and work performed in eye, ear, nose, and throat clinics—Continued.

	Number.		Number.
Pterygium:		Tarsal tumors.....	14
Ablation.....	39	Tenotomy.....	13
Transplantation.....	79	Tonsillectomy.....	241
Removal of—		Tonsillotomy.....	7
Aural polyp.....	2	Tracheotomy.....	1
Foreign body from ear.....	2	Turbinectomy.....	70
Nasal polyp.....	22	Uvulotomy.....	4
Septal spurs.....	22	Various minor operations.....	1,628
Sinusotomy, maxillary radical.....	2		
Subconjunctival cysts.....	5	Total.....	2,771
Submucous cyst extirpated.....	1	Refractions.....	3,290
Submucous resection of nasal septum.....	198	Outside cases treated.....	20,186
Subperiosteal abscess.....	1		
Suture, lacerated sclera.....	1	Grand total.....	26,247

Consolidated ward laboratory report of all hospitals.

	Number.		Number.
Blood examinations.....	21,627	Urine examinations.....	33,636
Estivo-autumnal.....	5,388	Albumen.....	7,697
Tertian, single.....	1,121	Albumen and casts.....	6,342
Tertian, double.....	14	Sugar.....	136
Mixed tertian and estivo-autumnal.....	44	Pus and blood.....	2,248
Quartan.....	100	Gonococci.....	23
Lepra bacilli.....	2	Epithelium.....	811
Differential blood counts.....	1,536	Bile.....	23
Leucocyte counts.....	3,514	Diazo reactions.....	24
Red blood counts.....	402	Microscopical examinations.....	962
Red and white blood counts.....	140	Trichomonas vaginatis.....	1
Hemoglobin estimations.....	883	Flagellated monads.....	2
Filaria.....	9	Diplococci.....	4
Spirillum Novyi.....	1	Tubercle bacilli.....	4
Guaiac and turpentine tests for invisible blood.....	519	Hemin crystals.....	76
Treponema.....	1	Guaiac tests.....	144
Erythrocyte counts.....	10	Red blood cells.....	11
Stool examinations.....	13,893	White blood cells.....	5
Hymenolepis nana.....	1	Pus and epithelium.....	226
Monadena.....	91	Phosphates.....	2
Ascaris lumbricoides.....	926	Ciliated monads.....	3
Uncinaria ova.....	1,839	Vermis.....	1
Tricocephalus dispar.....	1,299	Bacilli, acid fast.....	1
Strongyloides intestinalis.....	515	Filaria.....	6
Tenia.....	10	Mucus.....	5
Tenia saginata.....	6	Sputum examinations.....	2,231
Ameba.....	204	Tubercle bacilli.....	394
Mucus.....	70	Pneumococci.....	1
Bathreoccephalus latus.....	1	Ameba.....	1
Ciliated monads.....	313	Blood.....	3
Bilharzia.....	1	Diplococci.....	1
Pus and blood.....	1,956	Miscellaneous:	
Pus and epithelial cells.....	59	Examinations of pleural effusions.....	2
Balantidium coli.....	15	Examinations of various smears and discharges.....	324
Tubercle bacilli.....	38	Examinations of spinal fluid.....	7
Entamoeba, tetragena.....	29	Examinations of vaginal and urethral discharges.....	99
Oxyuris vermicularis.....	6	Examinations of pus, blood, and tissue.....	14
Entamoeba, histolytica.....	24	Diplococci.....	4
Thymol treatments.....	34	Gastric analyses.....	111
Entamoeba coli.....	20	Test to determine coagulation period of blood.....	1
Trichuris trichinura.....	3	Skin scrapings.....	6
Bile.....	1	Stomach contents.....	6
Red blood cells.....	16		
Flagellated monads.....	6		
Guaiac tests.....	4		
Curds.....	1		

ANCON HOSPITAL.

Class.	Remain- ing July 1.		Admitted.		Died.		Discharged.		Transferred.		Remain- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Isthmian Canal Commis- sion employees.....	340	502	7,014	7,296	60	158	5,069	7,197	1,980	66	245	377
Panama R. R. employees.	19	111	418	2,091	.....	74	321	2,026	95	13	21	89
Pay patients.....	86	46	2,303	1,149	47	91	2,116	1,014	133	25	93	65
Charity patients.....	6	36	297	630	10	127	280	489	.....	26	13	24
Insane patients.....	34	305	21	194	.....	28	14	136	16	74	25	261
Total.....	485	1,000	10,053	11,360	117	478	7,800	10,862	2,224	204	397	816

	White.	Colored.	Total.
Average number of days' treatment per employee for the year.....	12.74	17.30	15.29
Average number of employees constantly sick during the year.....	261.97	450.69	712.66
Number of days' relief furnished patients.....			423,058
Cost of subsistence per patient per day.....			\$0.211

Nationality.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Isthmian Canal Commission employees.....	15,152	2,559	24	4,487	8,082
Panama R. R. employees.....	2,639	193	.....	230	2,216
Pay patients.....	3,584	1,509	.....	847	1,228
Charity patients.....	969	146	1	104	718
Insane patients.....	554	9	.....	43	502
Total.....	22,898	4,416	25	5,711	12,746

Operations.—(See report of all surgical operations.)
Laboratory report.—(See consolidated ward laboratory report.)

COLON HOSPITAL.

Class.	Remaining July 1.		Admitted.		Died.		Discharged.		Trans- ferred.		Remain- ing June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Isthmian Canal Commission em- ployees.....	108	76	2,632	995	20	40	2,047	964	595	12	78	55
Panama R. R. employees.....	21	53	542	633	6	30	401	622	141	10	15	24
Private pay.....	24	33	986	899	19	94	937	800	27	2	27	36
Municipal pay.....	1	6	32	131	3	26	27	103	.....	2	3	6
Zone charity.....	15	38	197	421	15	58	181	362	1	10	15	29
Total.....	169	206	4,389	3,079	63	248	3,593	2,851	764	36	138	150

	White.	Colored.	Total.
Average number of days' treatment per employee for the year.....	12.75	21.27	15.68
Average number of employees constantly sick during the year.....	111.84	97.53	209.37
Number of days' relief furnished patients.....			117,817
Cost of subsistence per patient per day.....			\$0.301

COLON HOSPITAL—Continued.

Nationality.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Isthmian Canal Commission employees.....	3,811	1,922	.....	718	1,171
Panama R. R. employees.....	1,249	339	.....	168	742
Private pay.....	1,942	667	.....	323	952
Municipal pay.....	170	1	.....	31	138
Zone charity.....	671	129	.....	86	456
Total.....	7,843	3,058	.....	1,326	3,459

Operations.—(See report of all surgical operations.)*Laboratory report.*—(See consolidated ward laboratory report.)

CULEBRA HOSPITAL.

Class.	Remaining July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Employees.....	.....	.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....
Nonemployees.....	1	8	65	226	1	6	62	208	3	14	.....	6
Total.....	1	8	66	226	1	6	63	208	3	14	.....	6

	White.	Colored.	Total.
Average number of days' treatment for employees for the year.....	1.00	.....	1.00
Average number of employees constantly sick during the year.....	.003	.....	.003
Number of days' relief furnished patients.....	.....	.....	2,890
Cost of subsistence per patient per day.....	.....	.....	\$0.228

Nationality.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Employees.....	1	1	.....	.....	.....
Noneemployees.....	300	16	5	49	230
Total.....	301	17	5	49	230

Operations.—(See report of all surgical operations.)*Laboratory report.*—(See consolidated ward laboratory report.)

PALO SECO LEPER ASYLUM.

Class.	Remaining July 1.		Admitted.		Died.		Discharged.		Transferred.		Remaining June 30.	
	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.	White.	Colored.
Employees.....	.....	.....	1	1	.....	.....	1	.....	.....	.....	1	1
Pay patients.....	1	30	1	1	.....	3	.....	.....	.....	.....	1	28
Charity patients.....	.....	13	1	9	.....	1	2	.....	.....	.....	1	19
Total.....	1	43	2	11	.....	4	1	2	.....	.....	2	48

REPORT ISTHMIAN CANAL COMMISSION.

PALO SECO LEPER ASYLUM—Continued.

	White.	Colored.	Total.
Average number of days' treatment per employee for the year.....	92.00	11.00	51.50
Average number of employees constantly sick during the year.....	.25	.03	.28
Number of days' relief furnished patients.....			17,578
Cost of subsistence per patient per day.....			\$0.308

Nationality.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Employees.....	2			1	1
Pay patients.....	32			1	31
Charity patients.....	23			1	22
Total.....	57			3	54

TABOGA SANITARIUM.

Class.	Remain- ing July 1.	Ad- mitted.	Died.	Dis- charged.	Trans- ferred.	Remain- ing June 30.
Employees.....	94	2,874	1	2,893	33	41
Families of employees.....	2	988		969	3	18
Total.....	96	3,862	1	3,862	36	59

Average number of days' treatment per employee for the year.....	6.74
Average number of employees constantly sick during the year.....	53.89
Number of days' relief furnished patients.....	27,764
Cost of subsistence per patient per day.....	\$0.651

Nationality.

Class.	Number treated.	Americans.	Other nations.
Employees.....	2,968	1,929	1,039
Families of employees.....	990	961	29
Total.....	3,958	2,890	1,068

NOTE.—No colored patients treated at Taboga Sanitarium.

SANTO TOMAS HOSPITAL.

Class.	Remain- ing July 1.	Ad- mitted.	Died.	Dis- charged.	Trans- ferred.	Remain- ing June 30.
Pay patients.....	33	1,434	23	1,414		30
Charity cases.....	245	5,503	438	5,098		212
Total.....	278	6,937	461	6,512		242

Average number of days' treatment per patient.....	14.00
Average number of patients constantly sick.....	266.80
Number of days' relief furnished patients.....	97,648
Cost of subsistence per patient per day.....	\$0.232

SANTO TOMAS HOSPITAL—Continued.

Nationality.

Class.	Number treated.	Americans.		Other nations.	
		White.	Colored.	White.	Colored.
Pay cases.....	1,467			414	1,053
Charity cases.....	5,748			788	4,960
Total.....	7,215			1,202	6,013

Operations.

	Number.	Died.
Major.....	508	25
Minor.....	750	
Total.....	1,258	25

Dispensary.

Class.	White.	Colored.	Total.
Natives.....	735	4,195	4,930
Foreigners.....	351	700	1,051
Total.....	1,086	4,895	5,981

Board of health laboratory.

Bacteriological examinations:		Chemical analyses:	
Municipal water supplies.....	116	Corrugated copper tubing.....	1
Water from condensers.....	130	Blood.....	1
Rain water.....	2	Stomach contents.....	20
Cultures from tonsil.....	2	Bismuth subgallate.....	1
Fluids and exudates.....	49	Urine.....	48
Cultures from ear.....	1	Water.....	1
Blood cultures.....	371	Various liquids, fluids, etc.....	27
Throat cultures (diphtheria suspects)...	2,586	Various metals.....	5
Cultures from autopsies.....	172	Earth.....	1
Cultures from eye.....	31	Pyrethrum.....	1
Stools.....	809	Santonin powder.....	2
Urine.....	273	Urinary calculus.....	1
Sputum.....	26	Hydrogen peroxide.....	1
Pus.....	22	Quinine solution.....	1
Stomach contents.....	10	Toilet powder.....	1
Hydrocele fluid.....	2	Sediment from pump chamber.....	1
Kneejoint fluid.....	18	Cement.....	1
Spinal fluid.....	31	Gastric contents.....	1
Discharge from urethra.....	1	Agglutination reactions.....	212
Various smears and specimens.....	69	Autopsies.....	722
Pleural fluid.....	5	Bodies embalmed.....	80
Cultures from spleen.....	1	Hydrophobia, preventative treatment...	5
Blood.....	4	Injections of anti-post serum.....	17
Fluid from femoral and inguinal glands..	2	Medico-legal postmortems.....	11
Auditory canal.....	1	Microscopical examination of stomach	
Skin eruption.....	1	contents.....	1
Fluid from chest.....	3	Sections of tissue prepared—	
Culture from abscess on back.....	1	Frozen.....	321
Cultures for meningitis.....	1	Paraffin.....	6,476
Abdominal fluid.....	3	Surgical pathological tissue and neo-	
Cultures from abdominal sinuses.....	4	plasms reported.....	358
Determinations:		Vaccination, smallpox.....	2
Chlorine content in water.....	62	Vaccination for plague.....	1
Specific gravity of sea water.....	4	Vaccines, mixed.....	9
Germicidal value of copper sulphide fluid	1	Vaccine inoculations, antityphoid.....	44
Effect of sulphur dioxide upon grass.....	1	Vaccine treatment, autogenous—	
Examinations:		Prepared.....	47
Leper suspects.....	27	Administered.....	46
"First-aid packets".....	4	Water, microscopical examination of....	49
Vomit.....	6	Water, sanitary analyses of.....	104
Nine clinical thermometers.....	1	Wasserman reactions.....	2,286
Gland from hog for anthrax.....	1	Widal reactions.....	97
Plague suspects.....	2		
Tuberculin test of hospital dairy herd....	81		

Issues of quinine.

Months.	Kilo-grams.	Pounds avoirdupois.	Months.	Kilo-grams.	Pounds avoirdupois.
July.....	84.00	185.19	March.....	114.00	251.32
August.....	85.504	188.50	April.....	184.46	407.10
September.....	60.50	133.38	May.....	14.85	32.74
October.....	96.00	211.64	June.....	42.44	93.56
November.....	55.70	122.80			
December.....	132.90	292.99	Total.....	942.704	2,078.73
January.....	19.00	41.89	Average per month.....	78.56	173.23
February.....	53.35	117.62			

Sanitation statistics.

CITY OF PANAMA.

Anopheles brigade:			Disinfection brigade—Continued.		
Ditches cleaned.....linear feet..	2,104,630		Number of rooms fumigated and disinfected.....		376
Ditches dug.....do.....	12,420		Material used:		
Weeds and grass cut and removed, square feet.....	5,098,346		Crude oil.....gallons..		3,850
Cess pools—			Larvaeide.....do.....		5,598
Cleaned.....	56		Destruction of rats:		
Filled.....	30		Rats caught and killed.....		11,010
Wells filled.....	14		Average number of rat traps in use..		287
Earth used in filling cesspools, wells, and holes.....cubic yards..	1,647		Inspection of houses and yards:		
Grass removed and burned...loads..	1,553		Houses and yards inspected.....		1,279
Disinfection brigade:			Persons notified to keep premises in good condition.....		362
Houses disinfected and fumigated for—			Warning notices complied with.....		407
Beriberi.....	3		Letters to Alcalde requesting enforcement of sanitary rules and regulations.....		59
Diphtheria.....	52		Shacks, stables, and old buildings condemned and demolished.....		70
Malaria fever.....	1		Yards cleaned.....		5,262
Tuberculosis.....	4		Loads of refuse removed from the city.....		5,439
Scarlet fever.....	1		New buildings:		
Typhoid fever.....	3		Plans submitted to health officer and approved.....		204
Wards, Ancon Hospital, disinfected and fumigated for plague.....	1				
Number of cubic feet disinfected and fumigated.....	1,114,532				

COLON, CRISTOBAL, MOUNT HOPE, TORO POINT, MARGARITA POINT.

Medical inspections:			Sanitation of Cristobal:		
Cases reported by medical inspectors.....	12		Pools oiled.....square yards..		57,740
Cases inspected.....	12		Water receptacles treated.....		52,000
Cases sent to hospital.....	12		Mosquito breeding places found.....		344
Water and sewers:			Ditches maintained.....linear feet..		600
Connections made during the year...	179		Sanitation of Mount Hope:		
Total connections made to date.....	846		Pools oiled.....square yards..		426,105
Outstanding permits.....	451		Water receptacles treated.....		282,835
Houses in which extensions were made.....	76		Ditches maintained.....linear feet..		244,337
Houses:			Mosquito breeding places found.....		1,835
Plans approved.....	176		Ditches constructed.....linear feet..		7,640
Permits to repair issued.....	237		Sanitation of Toro Point:		
Permits to occupy issued.....	120		Pools oiled.....square yards..		553,040
Temporary permits to occupy issued.....	34		Water receptacles treated.....		64,710
Houses in which defective plumbing fixtures were found and reported to superintendent of public works....	805		Mosquito breeding places found.....		296
Sanitation of Colon:			Ditches constructed.....linear feet..		29,448
Loads of yard garbage removed.....	5,712		Ditches maintained.....do.....		126,635
Average number of cans of garbage removed daily.....	2,159		Crab holes worked.....		6,800
Vegetation removed.....acres..	217		Doses quinine tonic distributed.....		59,688
Streets cleaned.....do.....	6,000		Adult mosquitoes killed.....		8,641
Private properties cleaned.....	1,080		Sanitation of Margarita Point:		
Pools oiled.....square yards..	256,050		Pools oiled.....square yards..		2,125
Mosquito breeding places found.....	1,989		Water receptacles treated.....		8,025
Water receptacles treated.....	331,678		Mosquito breeding places found.....		1
Ditches constructed.....linear feet..	5,980		Ditches maintained.....linear feet..		425
Ditches maintained.....do.....	222,001				
Notice to abate nuisances served.....	5,094				
Nuisances abated.....	3,449				
Buildings inspected.....	50,351				
Alleys cleaned.....square yards..	1,480,255				
Streets sprinkled.....do.....	1,128,000				
Colon and Cristobal garbage disposed of at dump, Colon.					

CANAL ZONE.

[Figures for entire year.]

Houses disinfected.....	130
Houses fumigated.....	5
Rats destroyed.....	8,373
Material used:	
Larvaeide.....gallons..	124,718
Crude oil.....do.....	719,835

Sanitation statistics—Continued.

CANAL ZONE—Continued.

[Figures for last six months of year.]

Work requests on quartermaster's department:		Building permits approved.....	249
Grass cutting.....	235	Inspections of closets.....	15,360
Screen repairs.....	212	Inspections of stores.....	3,061
Miscellaneous.....	294	Inspections of restaurants.....	1,101
Work requests on engineering department.....	429	Inspections of shops.....	1,022
Work requests on other departments.....	31	Garbage cans emptied.....	974,442
Notice served for abatement of nuisances.....	1,567	Closets disinfected.....	70,388
Arrests for violation of sanitary regulations.....	82	Rat traps used daily.....	413
Convictions.....	77	Water and sewer connections made.....	13
		Adult anopheles destroyed at houses.....	117,630
		Adult culices destroyed at houses.....	77,992
		Containers found with stegomyia larvæ.....	421

Quarantine service.

PORTS OF PANAMA-ANCON AND COLON-CRISTOBAL.

Vessels inspected and passed.....	1,342	Persons embarked for foreign ports:	
Vessels detained in quarantine.....	67	Cabin.....	22,015
Vessels fumigated on arrival.....	102	Steerage.....	19,673
Vessels fumigated prior to departure.....	37		41,688
Pieces of baggage disinfected.....	79	Apparent increase for the year from foreign ports:	
Crews inspected.....	111,164	Cabin (decrease).....	1,526
Passengers inspected.....	69,508	Steerage (increase).....	3,121
Total persons inspected.....	180,672		1,595
Persons vaccinated at ports of arrival because of compulsory vaccination law.....	12,956	Persons arriving from coast towns on small craft.....	32,366
Persons vaccinated at ports of departure or en route because of compulsory vaccination law.....	14,764	Persons embarked for coast towns on small craft.....	27,522
Total persons vaccinated.....	27,720	Apparent increase for the year from coast towns.....	4,844
Persons held in quarantine at the detention stations to complete period of incubation of yellow fever or plague.....	5,675	Total persons landed.....	75,649
Persons held in quarantine at the detention stations to determine if cholera bacillus carriers.....	467	Total persons embarked.....	69,210
Persons held in quarantine on board vessels to complete period of incubation of yellow fever or plague.....	10,741	Excess over number embarked.....	6,439
Total persons held in quarantine.....	16,883	Less number for Pacific ports.....	2,913
Persons landed from foreign ports:		Total apparent increase for the year.....	3,526
Cabin.....	20,489	Immigrants recommended for rejection.....	179
Steerage.....	22,794	Certificates issued to outgoing passengers.....	605
	43,283	Persons refused certificates because of trachoma.....	78
		Bills of health viséed.....	742
		Pieces of baggage handled and stored.....	10,078

BOCAS DEL TORO.

Vessels inspected and passed.....	368	Persons held to complete period of incubation of yellow fever.....	385
Crews inspected and passed.....	14,698	Vessels fumigated at request of owners.....	1
Passengers inspected and passed.....	7,400		
Passengers, in transit, inspected and passed.....	2,983		

Personnel report.

[Average number of employees at work during the year.]

Chief sanitary office.....	41	Dispensaries—Continued.	
Property division.....	9	Empire.....	11
Quarantine service.....	37	Gatun.....	17
Health office, Panama.....	58	Gorgona.....	9
Health office, Colon.....	115	Las Cascadas.....	7
Ancon Hospital.....	539	Margarita Point.....	1
Colon Hospital.....	193	Miraflores.....	7
Santo Tomas Hospital.....	6	Naos Island.....	2
Taboga Sanitarium.....	26	Nombre de Dios.....	2
Palo Seco Leper Asylum.....	14	Paraiso.....	5
Zone sanitation.....	257	Pedro Miguel.....	5
Dispensaries:		Porto Bello.....	4
Ancon.....	4	San Pablo.....	3
Balboa.....	3	Tabernilla.....	3
Bas Obispo.....	7	Toro Point.....	4
Corozal.....	3		
Cristobal.....	8	Total.....	1,412
Culebra.....	12		

Hospital cases of malaria among employees.

Months.	Discharged.		Died.		Total cases.	Annual average per 1,000 of deaths.	Annual average per 1,000 of cases.	Number of employees.
	White.	Colored.	White.	Colored.				
July.....	747	1,226	4	4	1,981	2.01	497	47,861
August.....	396	506	3	2	907	1.21	219	49,710
September.....	322	339	3	.....	664	.76	168	47,400
October.....	253	249	1	.....	503	.24	121	49,812
November.....	199	210	4	1	414	1.19	99	50,420
December.....	191	193	1	1	386	.47	91	50,655
January.....	251	247	2	.....	500	.46	116	51,852
February.....	251	257	1	1	510	.46	117	52,235
March.....	202	144	.....	.....	346	.....	81	51,095
April.....	127	109	.....	1	237	.24	56	50,612
May.....	166	93	.....	.....	259	.....	69	49,421
June.....	234	191	3	.....	428	.73	105	49,086
Total.....	3,339	3,764	22	10	7,135	.64	143	50,008

APPENDIX Q.

REPORT OF A. B. DICKSON, SUPERINTENDENT OF CLUBHOUSES.

ISTHMIAN CANAL COMMISSION,
OFFICE OF SUPERINTENDENT OF CLUBHOUSES,
Culebra, Canal Zone, August 1, 1912.

SIR: I have the honor to submit herewith the annual report of the operations of the division of clubhouses for the fiscal year ending June 30, 1912, as conducted under the supervision of the secretaries furnished by the Young Men's Christian Association.

ORGANIZATION.

On June 30, 1912, clubhouses were in operation at seven points, viz, Corozal, Culebra, Empire, Gorgona, Gatun, and Cristobal on the Canal Zone, and Porto Bello, 20 miles down the coast.

At the end of the fiscal year 42 gold employees and 64 silver employees were working for this division. Twelve of the gold employees were paid from commission funds, while 30 were paid from Young Men's Christian Association funds. Of the silver employees, 43 were paid from commission appropriations, while 21 were paid from Young Men's Christian Association funds.

The gold force operating the clubhouses consisted of 1 superintendent, 7 secretaries, 4 assistant secretaries, 1 clerk, 10 night clerks, 6 bowling-alley night attendants, 6 pool-room night attendants, and 7 barbers.

NEW EQUIPMENT.

During the year bowling alleys, locker rooms, shower baths, and a barber shop were added to the Corozal clubhouse, at a cost of about \$5,000, thereby greatly increasing the efficiency of the work done at that point.

MEMBERSHIP.

	1911-12	1910-11
Total membership, end of fiscal year.....	2,092	1,872
Average monthly membership.....	1,944	1,947
Largest membership any given month.....	¹ 2,092	² 2,121
Smallest membership any given month.....	³ 1,784	⁴ 1,712

¹ June. ² January. ³ August. ⁴ July.

Fifty-eight per cent of the gold employees living in clubhouse towns were members of the Young Men's Christian Association at the end of the fiscal year. By referring to the chart (plate 110), variations in membership and percentage of membership may be traced from the time the first census figures were published.

ENTERTAINMENTS.

	1911-12	1910-11
Companies engaged from the United States.....	7	5
Entertainments given.....	85	65
Total attendance.....	20,865	13,828
Entertainments given by local talent and moving pictures.....	406	277
Total attendance.....	96,072	56,708

Amateur oratorio societies, operatic troupes, minstrel troupes, glee clubs, mixed choruses, vaudeville, and black-face sketches were organized during the past year through the efforts of the members cooperating with the secretaries. Many of these organizations appeared at the various towns along the line.

The weekly moving picture exhibitions have become about the most popular form of entertainment on the Zone. A man is employed to give his entire attention to these exhibitions. Reels are ordered direct from the United States, and a careful selection is made, which includes occasional educational features.

BOWLING, BILLIARDS, AND POOL.

Special tournaments were organized among the clubhouses during the year. Gold, silver, and bronze medals were awarded the winners, and the attendance at the contests was large. There were 104,954 games bowled, as compared to 88,085 during the previous year. There were 278,799 games of pool and billiards played, as compared to 217,710 for 1910-11.

PHYSICAL WORK AND ATHLETICS.

Trained physical directors have continued the policy of giving to employees the various forms of exercise most beneficial to their health. There was an attendance of 15,199 at gymnasium classes during the year.

A pentathlon meet was held at Empire on February 22 for the purpose of developing all-around athletes.

A great deal of interest was developed in the "Health League," organized for the purpose of spreading useful knowledge as to the proper care of the body.

The Inter-Association Basket Ball and Indoor Base Ball Leagues were organized as usual. The contests were viewed by large crowds.

RELIGIOUS MEETINGS.

The policy of holding religious meetings and song services at such times as not to interfere with the organized religious work on the Zone has been continued. The average attendance at 214 meetings was 50, and the average attendance at Bible and discussion clubs was 52.

EDUCATIONAL WORK.

A great deal of interest was manifested in the study of Spanish, classes being conducted in six clubhouses. The average enrollment was 65.

The work of the literary and debating societies has been of real educational value to the members, and a source of pleasure to those whom they entertained.

Libraries range from 600 to 1,400 volumes according to the town. Forty-two thousand one hundred and ninety-five books were withdrawn for home reading during the year as compared to 30,837 the previous year. The reading rooms are supplied with the leading newspapers and periodicals of the day.

REFRESHMENT COUNTERS.

Soft drinks, ice cream, light lunches, etc., are served on the cool verandas of the clubhouses, a very popular privilege and extensively enjoyed. The total income from this direction during the past fiscal year was \$49,398.05 as compared to \$36,421.08 for the previous year.

COMMITTEES.

Various committees are appointed from time to time by the secretaries as occasion demands. There are committees on bowling, pool and billiards, membership, entertainment, etc. Important work was done by the visitation of the sick committee, who made 3,844 calls on hospital patients during the year.

BOYS' DEPARTMENT.

Boys from 10 to 16 years of age are allowed special privileges in the clubhouses. The secretary endeavors to arrange several outings during the year, and so far as possible guides the activities of the boys into safe and helpful channels. The total boys' membership on June 30 was 146.

FINANCES.

	1911-12	1910-11
Disbursements from commission funds.....	\$50,565.61	\$51,193.90
Disbursements from clubhouse funds.....	114,732.02	81,510.51
Receipts for the year	118,390.56	91,723.76
Net balance, June 30.....	16,803.74	11,945.20

The financial management is in the hands of an advisory committee appointed by the chairman and chief engineer. This committee consists of Col. W. C. Gorgas, chief sanitary officer; Mr. H. A. A. Smith, examiner of accounts; Mr. Joseph Bucklin Bishop, secretary of the commission; Maj. H. A. Brown, chaplain, United States Army, and Mr. A. B. Dickson, superintendent of clubhouses.

The general supervision of each clubhouse is in the hands of an executive council appointed by the international committee of the Young Men's Christian Association.

Respectfully,

A. B. DICKSON,
Superintendent of Clubhouses.

Col. GEORGE W. GOETHALS, U. S. Army,
Chairman and Chief Engineer, Culebra, Canal Zone.

APPENDIX R.

REPORT OF MAJ. F. C. BOGGS, CORPS OF ENGINEERS, UNITED STATES ARMY, GENERAL PURCHASING OFFICER AND CHIEF OF THE WASHINGTON OFFICE.

ISTHMIAN CANAL COMMISSION,
Washington, D. C., July 20, 1912.

SIR: I have the honor to submit the following report upon the work of this office during the fiscal year ending June 30, 1912:

There have been no changes in the organization of the office during the past year, the following divisions, all under my charge as general purchasing officer and chief of office of the Isthmian Canal Commission, being still maintained: General office, disbursing office, office of assistant examiner of accounts, appointment division, correspondence and record division, and purchasing department.

The work of the appointment division has been continued along the lines set forth in the last annual report. During the last 12 months 1,296 persons within the United States were tendered employment for duty on the Isthmus in grades above that of laborer; 632 accepted and were appointed, covering 51 different positions; 4,660 persons, including new appointees, those returning from leave of absence, and members of employees' families, were provided with transportation from the United States to the Isthmus, and in response to inquiries and applications for employment during this period, and in the issuance of appointments, 18,315 letters were written, 2,786 telegrams sent, and 13,294 circulars mailed.

The work of the correspondence and record division, in which is conducted all general or administrative correspondence, etc., has been continued along the lines described in previous annual reports.

The operations of the disbursing office have been continued in the same manner as indicated in previous annual reports, and the following show the transactions of the office during the past fiscal year:

Claim statement.

On hand July 1.....	42
Received July 1 to June 30.....	22, 690
Total.....	22, 732
Passed for settlement July 1 to June 30	22, 224
On hand June 30.....	508
61012°—12—36	561

Financial statement.

On hand July 1, 1911.....		\$561, 657. 98
Receipts:		
From United States Treasury.....	\$10, 505, 000. 00	
Liquidated damages.....	55, 888. 57	
Cash discounts.....	1, 437. 95	
Miscellaneous collections.....	103, 408. 44	
		10, 665, 734. 96
		11, 227, 392. 94
Disbursements:		
Claims paid.....	11, 033, 421. 22	
Deposits to "Miscellaneous receipts".....	23, 707. 64	
		11, 057, 128. 86
Balance on hand June 30, 1912.....		170, 264. 08
		11, 227, 392. 94

Claims aggregating \$86,484.86, which were examined in this office and settled by the Auditor for the War Department either by direct or transfer settlements, are not included in the above statement.

The assistant examiner's office has continued its work during the past fiscal year along the lines fully described in the last annual report.

The purchasing department as now organized was by Executive order dated August 15, 1907, placed under the supervision of the Chief of Engineers, United States Army, with an officer of the Corps of Engineers in charge as general purchasing officer. Headquarters of the department are located at Washington, D. C., from which office the principal purchases are made. Additional offices for the purchase of materials which can best be obtained locally, each in charge of an officer of the United States Army, are maintained at New York, N. Y., under an assistant purchasing officer, and at New Orleans, La., and San Francisco, Cal., under assistant purchasing agents, these offices also arranging for the receiving and shipping of all materials which are purchased for forwarding to the Isthmus through their respective ports. Necessary medical and hospital supplies are bought through the medical supply depot of the Army located in New York, N. Y., a small force of employees of the commission being detailed in that depot to carry on the work under the officer in charge.

No change has been made in the methods of purchase during the past year; the same system of circular invitations for bids and awards thereunder as described in previous annual reports still prevails. A wide distribution of these circulars is obtained by newspaper advertising and through the field offices of the Corps of Engineers, which are located at various points in the United States. Manufacturers in all parts of the country are thereby enabled to learn the commission's requirements and to submit bids for delivery through ports nearest their plants. The system, originated in April, 1909, of making annual contracts for staple articles which are required in the maintenance and repair of plant and equipment, has been continued, such contracts having been found economical from the standpoint of both the Government and the contractors. Efforts have been made from time to time to induce foreign firms to bid on our requirements, but with very unsatisfactory results.

Materials purchased are inspected in the United States before shipment, the right being reserved to make final inspection on the Isthmus after arrival there. To conduct the preliminary inspection a

force of inspectors is employed under the direction of the inspecting engineer in Washington. Inspections are also made, when practicable, by the field offices of the Corps of Engineers. Valuable assistance in the work of purchasing, testing, and inspecting is rendered the commission by the Bureau of Standards, the Bureau of Mines, the Bureau of Chemistry, the Bureau of Forestry, and the Medical, Quartermaster's, Subsistence, and Ordnance Departments, United States Army.

The total of orders placed for the fiscal year ended June 30, 1912, by all offices of the purchasing department in the United States amounted to \$10,446,551.23, the most important contracts for permanent equipment being structural lock material, \$386,274.60; electric locomotives and tracks, \$249,258.44; spillway gates and materials, \$526,697.03; machinery for the operation of locks and spillways, \$2,271,582.01; hydroelectric station, \$156,586.58; steel cylinders, girders, and reenforcing bars for docks, \$394,882.94; 1 bascule bridge, \$24,390; and 8 electric cargo-handling cranes, \$91,720.56. Other principal items of purchase included 13 locomotive cranes, 10,105,000 pounds dynamite, 34,424,500 feet of lumber, 194,100 crossties, 162 sets of switch ties, and 7,259 gross tons of steel rails.

Under a contract for 4,500,000 barrels of Portland cement, entered into January 7, 1909, a total of 4,354,024 barrels has been shipped, of which 1,579,210 barrels were delivered during the past year. The construction of lock gates and machinery for operating the locks and spillways has continued satisfactorily during the year, the preliminary inspections being continued by independent inspecting offices described in the last report.

Very respectfully,

F. C. BOGGS,
Major, Corps of Engineers, United States Army,
General Purchasing Officer, Chief of Office.

Col. GEO. W. GOETHALS, U. S. Army,
Chairman and Chief Engineer,
Culebra, Canal Zone.

APPENDIX S.

TABLES SHOWING INCREASES IN SALARIES AUTHORIZED OVER ORGANIZATION OF JULY 1, 1910, AND INCREASES OF NUMBER OF PERSONS EMPLOYED OVER NUMBER ALLOWED IN 1912 BOOK OF ESTIMATES, AS REQUIRED BY ACT OF CONGRESS APPROVED MARCH 4, 1911.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER.					
FIRST DIVISION.					
Designing force:					
Designing engineer.....	\$6,000.00	.....	.....	1	1 formerly rated at \$5,400, in- creased account duties com- bined with duties of one other designing engineer— dropped.
Assistant engineer.....	2,700.00	2	2	3	4 assistant engineers at \$3,000 asked for in Book of Esti- mates, only 3 being em- ployed, the remaining one rated at \$2,700.
Draftsman.....	2,400.00	1	1	2	{ 1 draftsman at \$2,400, 4 at \$1,800, 1 at \$1,500, and 1 tracer at \$900, put on on account of increased work in first division.
Do.....	1,800.00	6	6	10	
Do.....	1,500.00	3	3	4	
Tracer.....	900.00	.....	.....	1	
Aids to navigation—Construc- tion force: ¹					
Blacksmith.....	486.40	.....	.....	1	
Do.....	316.16	.....	.....	1	
Boatman.....	450.00	.....	.....	4	
Captain, launch.....	900.00	.....	.....	1	
Cement men.....	316.16	.....	.....	94	
Clerk.....	360.00	.....	.....	2	
Do.....	1,800.00	.....	.....	1	
Carpenter.....	608.00	.....	.....	4	
Do.....	486.40	.....	.....	4	
Do.....	389.12	.....	.....	7	
Concrete finisher.....	608.00	.....	.....	2	
Do.....	486.40	.....	.....	2	
Do.....	389.12	.....	.....	3	
Concrete laborer.....	389.12	.....	.....	15	
Draftsman.....	2,100.00	.....	.....	2	
Engineer.....	.....	.....	.....	.....	
Engineer, assistant.....	4,200.00	.....	.....	1	
Engineer, junior ²	220.00	.....	.....	1	
Engineer, launch.....	900.00	.....	.....	1	
Engineer, stationary.....	900.00	.....	.....	1	
Foreman.....	1,800.00	.....	.....	1	
Do.....	900.00	.....	.....	4	
Do.....	810.00	.....	.....	1	
Do.....	600.00	.....	.....	1	
Do.....	450.00	.....	.....	2	

¹ This subdivision first organized in February, 1911.

² In addition to Army pay.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
FIRST DIVISION—continued.					
Aids to navigation—Construc- tion force—Continued.					
Laborer.....	\$316.16			12	
Do.....	243.20			56	
Levelman.....	1,500.00			2	
Rodman.....	1,000.00			2	
Seaman.....	420.00			2	
Supervisor.....	2,700.00			1	
Transit man.....	1,800.00			1	
Water boy.....	170.24			2	
Watchman.....	360.00			1	
Machinery erection and elec- trical installation: ¹					
Blacksmith.....	1,617.20			1	
Do.....	1,094.72			1	
Boys.....	170.24			6	
Carpenters.....	1,741.60			4	
Do.....	1,617.20			5	
Do.....	1,393.28			4	
Do.....	608.00			13	
Do.....	486.40			28	
Do.....	389.12			83	
Do.....	316.16			14	
Concrete finishers.....	608.00			2	
Do.....	486.40			14	
Do.....	389.12			37	
Concretemen.....	316.16			38	
Chainmen.....	360.00			14	
Clerks.....	2,100.00			1	
Do.....	1,800.00			1	
Do.....	1,500.00			2	
Do.....	1,200.00			1	
Do.....	600.00			1	
Do.....	510.00			1	
Do.....	450.00			1	
Erectors.....	1,680.00			9	
Do.....	1,800.00			15	
Do.....	1,393.28			3	
Do.....	1,244.00			1	
Do.....	1,094.72			12	
Do.....	945.44			11	
Do.....	796.16			8	
Firemen.....	420.00			2	
Do.....	480.00			5	
Foremen, general.....	2,100.00			4	
Do.....	1,800.00			15	
Do.....	1,500.00			5	
Do.....	1,200.00			3	
Do.....	450.00			1	
Do.....	750.00			5	
Do.....	900.00			1	
Hostlers.....	450.00			2	
Ironworkers.....	316.16			15	
Laborers.....	486.40			59	
Do.....	389.12			13	
Do.....	243.20			26	
Levelmen.....	1,500.00			2	
Do.....	1,200.00			2	
Machinists.....	1,617.20			2	
Do.....	608.00			3	
Do.....	486.40			4	
Do.....	389.12			31	
Do.....	316.16			10	
Messengers.....	360.00			2	

¹ Work in this subdivision was first organized in September, 1911.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—contd.					
FIRST DIVISION—continued.					
Machinery erection and elec- trical installation—Contd.					
Pipefitters.....	\$1,617.20			2	
Do.....	1,393.28			2	
Do.....	389.12			13	
Do.....	316.16			8	
Riggers.....	316.16			50	
Redmen.....	1,000.00			2	
Do.....	900.00			2	
Superintendent.....	3,600.00			1	
Superintendent, assistant	3,300.00			1	
Supervisors.....	3,000.00			2	
Painters.....	486.40			19	
Do.....	389.12			20	
Do.....	316.16			29	
Steam engineers.....	1,800.00			5	
Do.....	1,500.00			1	
Do.....	1,620.00			1	
Transitman.....	1,800.00			1	
Watchman.....	450.00			2	
Wiremen.....	1,617.20			2	
Do.....	1,393.28			5	
Do.....	1,094.72			1	
Do.....	486.40			1	
Do.....	389.12			5	
Do.....	316.16			2	
SECOND DIVISION.					
[Including former third divi- sion abolished Jan. 24, 1912.]					
Draftsman.....	1,800.00	2	2	4	1 in place of authorized posi- tion at \$2,400; other 1 au- thorized because of increased work not antici- pated when estimates for 1912 were made. See note A below.
Clerk.....	2,100.00	1		1	In lieu of position at \$2,400 estimated for.
Inspector of shops.....	2,500.00	1	1		Increased duties and respon- sibilities.
(Including \$4,000 Army pay.)	3,200.00			1	
Clerk.....	2,100.00			1	The clerical work for the in- spector of shops was for- merly done by the fourth division. Owing to in- crease in the work, a clerk was regularly assigned to this office. Appointed at \$1,500; designated assistant secretary, isthmian civil- service bureau, Aug. 14, 1910; promoted to \$1,800 Sept. 1, 1910; promoted to \$1,950 Jan. 1, 1911; pro- moted to \$2,100 July 1, 1911; designated as secretary, isthmian civil service bu- reau, Apr. 1, 1912.
Inspector of fuel and lubricants.	2,100.00			1	In lieu of authorized position of traveling engineer at \$3,000.
Supervisor.....	2,700.00			1	Authorized May, 1912, after position of assistant engi- neer at \$6,000 was abolished.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
SECOND DIVISION—continued.					
Inspector.....	\$2,400.00	1	.....	1	Abolished May, 1912, when position of supervisor was authorized.
Hydrographer.....	1,800.00	2	1	2	During time there were 2 hydrographers at \$1,500 and 2 at \$1,800 on the rolls, the positions of principal hydrographer and hydrographer at \$1,200 were unfilled.
Do.....	1,500.00	1	1	2	
Do.....	1,200.00	.....	1	1	In place of authorized position of observer at \$1,200.
Observers (silver).....	60.00	2	.....	2	To insure receipt regularly of rainfall reports from Chepo and Chorrora, which were received only occasionally while observers were unpaid.
Assistant engineer.....	6,000.00	1	1	1	Position abolished Jan. 24, 1912.
Do.....	3,300.00	1	.....	1	Position abolished June 19, 1912.
Do.....	2,700.00	3	.....	3	See notes A and B below.
Junior engineer.....	2,400.00	2	2	3	Do.
Foreman, general.....	1,800.00	2	2	2	Incumbent received \$1,200 per year.
Storekeeper.....	1,500.00	.....	.....	1	In place of authorized position of foreman at \$2,100.
Transitman.....	2,100.00	2	1	2	See note A below.
Do.....	1,800.00	6	2	7	See notes A and B below.
Levelman.....	1,500.00	4	3	4	Do.
Do.....	1,200.00	2	.....	7	Do.
Rodman.....	1,000.00	7	5	7	Do.
Cook.....	600.00	7	7	9	Incumbents received only \$480 each. See notes A and B below.
Foreman.....	450.00	.....	.....	1	In place of one authorized boatman at \$450.
Chainman.....	360.00	.....	.....	9	Rated from laborers, as better designation for class of work performed.
Laborers.....	397.80	120	60	208	See notes A and B below.
Terminal design—Docks and coaling plants:					
Assistant engineer.....	3,000.00	.....	.....	1	See note C below.
Incumbent received \$1,032 in addition to \$3,168 Navy pay.					
Draftsman.....	2,400.00	.....	.....	1	Do.
Do.....	1,800.00	.....	.....	2	Do.
Permanent shops:					
Assistant engineer.....	3,000.00	.....	.....	1	Do.
Draftsman.....	1,500.00	.....	.....	1	Do.

NOTE A.—Increases in number of assistant and junior engineers, transitmen, levelmen, rodmen, cooks, and laborers, due to transfers to office of chief engineer of Panama Railroad force employed on property surveys, and to survey work for department of law, none of which was anticipated at time of making estimates for 1912.

NOTE B.—Maximum number of assistant and junior engineers, transitmen, levelmen, rodmen, cooks, and laborers employed during July and August when work was rushed on Canal Zone land survey by direction of chief engineer. Force greatly decreased balance of fiscal year so that the aggregate for the year averaged very much below the estimate.

NOTE C.—Work had not been authorized when estimates were submitted for 1912.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
FOURTH DIVISION.					
Clerks.....	\$1,500.00	2	1	2	See under "Telegraph operator."
Geologist.....	3,000.00	.....	.....	1	By direction of the President, Dr. C. W. Hayes, Chief Geologist, Geological Survey, was instructed to make a preliminary examination and study of the geologic formations on the Canal Zone. Upon his recommendation a permanent geologist at \$3,000 per year was appointed for service with the Isthmian Canal Commission.
Assistant surveying officer.....	2,100.00	.....	.....	1	The salary of the assistant surveying officer was originally fixed at \$1,800 per year. Since then other duties, as the transfers of equipment, appraisals of sales, appraisals of buildings, and adjusting errors in property records, have been given the surveying officer. On account of the great increase in work due to these additional duties, the salary of the assistant surveying officer was increased to \$2,100.
Telegraph operator.....	1,500.00	1	1	.....	Designation of this position changed to "Clerk" on account of nature of duties and incumbent having been certified as clerk by Civil Service Commission.
Inspector (motor cars).....	2,280.00	.....	.....	1	On account of increase in number of motor cars, an inspector having authority to order repairs and recommend changes in all of the cars was found to be necessary. The inspecting was added to the duties of one of the regular motormen and salary increased on account of increased duties and responsibility.
Photographer's assistant.....	600.00	.....	.....	1	One of the messenger force is assigned to the photographer and on account of increased duties and long and efficient service was increased to \$600 per year.
Trainmen.....	420.00	2	2	5	Increase of 1 trainman made necessary on account of additional motor car. The increase of 2 more was only for a few days while new men were being broken in to take the places of men leaving the service.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
SECRETARY'S OFFICE.					
Clerks.....	\$2,100.00	2	2	1 2	
Clerk.....	1,800.00			1 1	
Inspector.....	2,100.00			1 1	
ATLANTIC DIVISION.					
Gatun office:					
Clerks.....	150.00	14	14	21	1 from Dock 13, 1 from Porto Bello, 4 from breakwater, 1 from municipal engineering.
Do.....	75.00	1	2	3	1 from Porto Bello.
Clerks (S).....	75.00	3	3	4	Do.
Clerks.....	62.50	2	2	3	Do.
Draftsmen.....	175.00	3	3	4	Transferred from dry dock.
Do.....	150.00	4	2	3	Increased drafting work, particularly of spare parts for equipment in need of repairs.
Messengers.....	37.50	2	2	3	1 from Porto Bello.
Motorman.....	150.00	1		1	Division engineer's inspection car. Omitted from estimate.
Dock 13 office:					
Messengers.....	37.50	3	2	3	From harbor and channel.
Breakwater:					
Coxswain.....	100.00		1	1	Licensed man.
Hostler.....	140.00			1	Hourly man not satisfactory.
Do.....	30.00			4	Do.
Dry dock:					
Foremen, shop.....	175.00	9	2	4	Increase to \$200 not approved.
Foremen.....	150.00	2	1	2	Increase to \$165 not approved.
Foreman (assistant).....	165.00			1	In lieu of leading man at 74 per cent.
Foremen.....	160.00			3	In lieu of leading man at 76 cents, 76 and 70.
Do.....	150.00			1	In lieu of leading man at 68 cents.
Do.....	145.00			1	In lieu of leading man at 65 cents.
Do.....	140.00			1	Do.
Clerk.....	50.00			1	In lieu of clerk at \$60.
Watchmen.....	37.50	5	4	5	In lieu of policeman at \$40.
Carpenters.....	.16	35	35	61	In lieu of higher ratings.
Engineer, steam.....	75.00			1	3 shifts in power plant.
Oilers.....	35.00	2		2	Omitted from estimate.
Do.....	30.00	2		2	Do.
Shipwrights.....	.65			2	Change of rating from ship-fitters.
Harbor and channel:					
Supervisor.....	225.00	1		1	Increase to \$250 not approved.
Foreman, general.....	225.00			1	Decrease from supervisor at \$250.
Foremen, general.....	150.00	1	1	2	1 transferred from Mindi.
Foremen.....	125.00	5	6	7	Do.
Mates.....	155.00	11	7	9	Extra men for sickness and vacation leaves.
Do.....	125.00	2		2	Transferred from Nombre.
Do.....	90.00			7	Error in estimate.
Carpenter.....	135.00			1	Change in designation from boilermaker.
Coalmen.....	30.00	14		14	Change of designation from seamen.

¹ On Sept. 26, 1910, 1 clerk at \$2,100 was made inspector at \$2,100, and 1 clerk at \$1,800 created. (Authority, letter of chairman of Sept. 28, 1910.) On May 6, 1912, 1 additional clerk at \$2,100 was employed during the absence on vacation leave of the assistant to the secretary.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
ATLANTIC DIVISION—contd.					
Harbor and channel—Contd.:					
Engineers, marine.....	\$135.00	2	3	6	In lieu of men at higher rates.
Do.....	125.00	3	4	11	Do.
Firemen.....	45.00	12	12	25	In lieu of higher rates.
Do.....	40.00			27	Do.
Do.....	30.00			3	Do.
Oilers.....	50.00	35	35	49	Do.
Operators.....	210.00		2	2	Increased from \$200 to \$210 account duties and responsibility on account of charge of night shift.
Do.....	135.00	2		2	Transferred from Nombre.
Seamen.....	32.50	10	20	30	In lieu of higher rates.
Do.....	30.00	30	100	206	Do.
Porto Bello:					
Superintendent.....	300.00			1	Reduction from \$325.
Clerk.....	50.00			5	In lieu of higher rates.
Do.....	45.00			1	Do.
Foremen.....	62.50			4	Do.
Foreman, assltant.....	160.00			1	In place of leading man at 70 cents.
Do.....	150.00			1	In place of leading man at 65 cents.
Blacksmith helper.....	.13			3	All helpers under that head.
Bricklayer.....	.20			1	In lieu of higher rates.
Car repairer.....	.20			5	In lieu of gold men.
Car-repairer helpers.....	.13			2	See "Helpers."
Engineer, Lidgerwood.....	125.00			1	Large rock quarry.
Engineer, steam.....	175.00	1		1	Increase not approved.
Do.....	50.00	18	6	17	In lieu of higher rates.
Firemen.....	37.50	7		8	Do.
Hostler.....	30.00	5	9	12	Error in estimate.
Laborers.....	.16	67	67	33	After 3 months' service 16-cent men increased to 20 cents.
Machinists.....	.16	6	6	15	Account increased repairs.
Riggers.....	.13	6	6	50	In lieu of higher rates.
Winchmen.....	50.00			2	Handling chains in Break-water quarry.
Locks:					
Foremen, general.....	200.00	2	2	3	Reduced from \$225.
Levelmen.....	100.00			2	Reduction in number authorized at \$125 and abolishing 1 rodman.
Transitmen.....	150.00	2	2	3	Setting fixed steel.
Cable splicer.....	125.00			1	Cableway repairs.
Carpenters.....	.65	30		28	Estimated for as foremen.
Cranemen.....	185.00	7	1	1	Back fill.
Engineers, steam shovel...	210.00	7	1	3	Do.
Laborers.....	.20	295	145	464	16-cent men to 20 cents after 3 months' service.
Pitmen.....	.16	50	17	36	Back fill.
Powder helpers.....	.20	26	12	26	Do.
Do.....	.16	25	15	25	Do.
Power plant:					
Pipefitters.....	.20			2	Transferred from locks.
Do.....	.16			6	Do.
Dam and spillway:					
Resident engineer.....	166.67			1	Increase in Army pay.
Supervisor.....	225.00	1	1	2	1 transferred from locks.
Do.....	100.00			2	In \$125 authorization.
Transitmen.....	150.00	2	2	3	1 from Porto Bello.
Cranemen, steam shovel...	185.00	2	2	7	4 transferred from Mindi; 1 transferred from Toro Point.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
ATLANTIC DIVISION—contd.					
Dam and spillway—Contd.					
Engineers, steam shovel...	\$210.00	2	2	8	3 from Mindi; 3 from Toro Point.
Engineers, steam.....	150.00	7	7	10	1 additional locomotive crane; 2 track-shifter engineers.
Operators.....	125.00	5	4	5	Extra man; sickness and vacation leave.
Pitmen.....	.16	20	20	76	56 from Mindi.
Powder helpers.....	.16	30	30	167	Additional dry fill.
Municipal engineering: Custodians.....	150.00			2	Charge of Brazos Brook and Agua Clara Reservoirs and each one-half Gatun-Mount Hope Road.
Foreman.....	100.00			1	Promotion of colored American.
Do.....	90.00			1	Estimated for at \$125.
Inspector.....	125.00			1	From Dec. 15, 1911, to June 1, 1911, conservation of water supply.
Messengers.....	37.50	1	1	2	1 additional for Agua Clara filter plant.
Watchmen.....	37.50	4	4	5	Do.
Chemist.....	200.00			1	Agua Clara filtration plant, new installation, and Zone water supply, Frioles to Porto Bello.
Operator, filter.....	150.00	1	2	1	Agua Clara plant, new installation.
Transportation:					
Messengers.....	37.50	4	4	8	For 4 additional towers in Gatun district.
Engineers, locomotive.....	150.00	13		12	Error in estimate.
Engineer, steam.....	165.00			1	Wrecking crane.
Firemen.....	50.00	16	16	35	Increase account 6 months satisfactory service.
Operator, telegraph.....	150.00			1	See "Dam and spillway."
Laborers.....	.20			11	From locks.
CENTRAL DIVISION.					
Accountant.....	2,100.00	1	1	2	1 clerk at \$2,100 rerated to conform to duties.
Apprentices.....	248.80		1	3	{ Competent American apprentices desired account rendering better service than silver men on same work.
Do.....	373.20			1	
Boilermakers.....	360.00			2	Changed from machinists to boilermakers to conform to duties in night steam-shovel repair gang.
Do.....	480.00			6	Do.
Do.....	600.00			1	Do.
Do.....	945.44	2	2	3	Increase authorized for purpose of securing men for boilermaker work at lower rates account large number of men leaving at same time.
Do.....	1,393.28	1	1	4	Do.
Carpenters.....	437.76	60	60	80	Account new plan of operation on Naos Island trestle, working 12 hours a day; two crews.
Channeler runner.....	1,800.00			1	Temporary increase in force; needed to operate channeler on 95-foot berm in Empire district.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
CENTRAL DIVISION—contd.					
Checker, shop.....	\$1,500.00	-----	-----	1	Checker at \$1,200 eliminated; material inspector at \$2,100 transferred causing increased duties, etc., for checker.
Clerks.....	510.00	2	2	4	Decrease at higher rates.
Do.....	540.00	1	1	2	Do.
Do.....	720.00	3	3	5	Do.
Do.....	900.00	2	2	7	Decrease in clerks at \$1,200 by 1, and in clerks at \$1,500 by 4.
Clerk, chief.....	3,000.00	-----	-----	1	Chief clerk at \$3,600 abolished; also assistant chief clerk at \$2,400.
Coalmen.....	300.00	28	28	35	No actual increase in force; organization increased account irregular work rendered by this class of employees, making it necessary to carry more men on rolls.
Concretemen.....	355.68	10	10	20	On account of experimental revetment in Empire and Culebra district.
Conductor.....	2,280.00	}	-----	1	{No actual increase; paid according to duties performed.
Conductor, foreman.....	2,520.00			1	
Conductor.....	2,280.00			1	Do.
Yardmaster.....	2,520.00			1	Foreman at same salary abolished.
Custodian.....	1,500.00	-----	-----	1	Account putting on night force in Culebra district; shovels too close to drilling operations.
Drill runners.....	355.68	350	350	530	{Authorized to reduce excessive amount of overtime around pumping stations; municipal engineering department corresponding reduction in hourly artisans.
Engineers, stationary.....	360.00	-----	-----	4	{Decrease in steam engineers at \$1,500. Rate authorized by chief engineer for Lidgerwood engineers.
Do.....	480.00	-----	-----	4	
Do.....	600.00	-----	-----	6	
Do.....	720.00	-----	-----	4	
Engineers, steam.....	1,650.00	-----	-----	14	Decrease necessary owing to inability to secure competent men to operate Bas Obispo sump.
Do.....	1,980.00	2	2	3	Decrease of firemen at higher rates.
Firemen.....	360.00	5	5	12	Do.
Do.....	420.00	-----	-----	6	Do.
Do.....	450.00	32	32	50	Do.
Do.....	480.00	4	4	10	Do.
Do.....	540.00	5	5	20	Do.
Foremen.....	360.00	3	3	10	Decrease of foremen at higher rates.
Do.....	450.00	31	31	35	Do.
Do.....	750.00	50	50	60	Do.
Do.....	1,920.00	-----	-----	1	Consolidation of position of conductor and steam engineer, aggregating \$275 per month.
Do.....	1,980.00	-----	-----	1	Decrease in higher rate; saving made in labor cost account sharpening drill steel.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
CENTRAL DIVISION—contd.					
Hostlers.....	\$300.00	15	15	35	Watchmen rerated as host- lers to conform to duties; increase also due to open- ing up shovel work in San Pablo and vicinity.
Inspector general.....	4,200.00			1	Position of general superin- tendent at \$5,000 abolished.
Janitor.....	360.00			1	Messenger rerated to conform to duties.
Levelmen.....	1,500.00	9	9	11	Temporary increase of 2, due to large number of men on leave who resign at expla- nation of same. Present force, 2.
Light keeper.....	600.00			1	Special rate authorized for American watchmen on end of Naos Island trestle. Inability to secure compe- tent man at lower rate for position (night).
Linemen.....	1,650.00			1	Position of linemen at \$1,500 abolished; particularly competent man for this class of work.
Machinists.....	360.00	15	21	23	Decrease in hourly rates; to eliminate overtime in night steam-shovel repair gang.
Do.....	608.00	7	5	7	Decrease in higher rates of machinists.
Do.....	1,393.28	7	7	10	Do.
Messengers.....	210.00	1	1	7	{ Various laborers in canal re- rated to conform to duties performed; hourly rates abolished.
Do.....	240.00	2	2	5	
Do.....	300.00	15	15	17	
Do.....	360.00	29	29	47	{ Additional towers in canal in transportation department requiring additional mes- sengers; trainmen at same rate rerated and number reduced accordingly.
Do.....	420.00	5	5	15	
Oilers.....	480.00			2	To eliminate overtime of hourly men at Bas Obispo Sump; hourly rates abol- ished.
Operators, telegraph.....	1,800.00			2	Assistant chief dispatcher at \$2,100 abolished; transfer of old Panama R. R. main line from Paraiso Junction to Corozal Junction to this division.
Pipe fitters.....	355.68	60	60	81	{ Account water conditions in canal; increased pumping work account drainage op- erations in cut; necessity for keeping shovels work- ing, etc.
Do.....	437.76	60	60	63	
Powder helpers.....	547.20	100	100	110	Temporary increase in Cule- bra Cut due to shovels get- ting too close to drilling operations.
Storemen.....	360.00	2	2	3	Clerks at same salary rerated.
Do.....	450.00	3	3	5	Do.
Switch tenders.....	273.60	180	180	210	{ Increase due to large number of crippled employees whom we are obliged to care for in some capacity or other.
Do.....	355.68	90	90	115	

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
CENTRAL DIVISION—contd.					
Towermen.....	\$900.00			8	Used in towers to transmit train orders; dissatisfaction among transportation men account receiving orders from colored employees; colored employees eliminated.
Watchmen.....	300.00	1	1	10	Decrease in higher rate of watchmen.
Wiremen.....	355.68			15	Laborers rerated to conform to duties in assisting blasting wiremen.
Do.....	437.76			15	Do.
Yardmasters.....	2,280.00			5	Decrease at higher rates; also conductors abolished to create yardmasters at same rating and to conform to duties performed.
PACIFIC DIVISION.					
Officers and employees:					
Engineer, assistant.....	4,500.00	1	1		
Do.....	3,300.00	2	2	2	
Do.....	3,000.00			2	For construction of Panama R. R. lumber dock.
Do.....	2,700.00			1	In lieu of junior engineer at \$2,700.
Clerks.....	2,100.00	4	4	6	2 increased from \$1,800 and assistant chief clerk abolished.
Do.....	1,800.00	15	24	14	
Do.....	1,500.00	22	29	17	
Do.....	1,350.00			2	
Do.....	1,200.00			4	
Do.....	900.00	5	3	7	
Do.....	750.00	2	1	2	
Do.....	720.00	8	8	4	
Do.....	600.00	9	29	5	
Do.....	540.00			7	
Do.....	510.00	2		6	
Do.....	480.00			1	
Do.....	450.00	8	4	17	
Do.....	360.00	9	2	22	
Computers.....	1,500.00	1	1	1	
Do.....	1,200.00			1	To get cost data Pedro Miguel Locks and data for permanent water supply.
Foremen, general.....	3,000.00	1	2		
Do.....	2,700.00			2	1 increased to \$2,700 account of increased mining and excavation south of Miraflores Locks.
Do.....	2,400.00	7	11	8	
Foremen, general.....	2,100.00	16	16	18	2 on waterworks increased from \$1,800 on account of additional work in water service.
Do.....	1,800.00	2	2		
Foremen, assistant.....	1,980.00			1	In lieu of 1 general foreman.
Foremen.....	2,700.00	1	1	1	
Do.....	2,400.00	3	4	1	
Do.....	2,100.00	17	21	6	
Do.....	1,950.00			2	
Do.....	1,800.00	38	97	38	
Do.....	1,650.00			11	
Do.....	1,500.00	36	77	25	
Do.....	1,350.00			13	
Do.....	1,200.00	3	7	13	
Do.....	900.00	28	37	32	

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
PACIFIC DIVISION—contd.					
Officers and employees—Con.					
Foremen.....	\$750.00	14	5	43	Account of 12-hour day on excavation and concrete operations.
Do.....	720.00	2	2		
Do.....	660.00			1	
Inspectors.....	1,500.00	1		1	Inspect water lines during dry season to conserve supply.
Do.....	1,200.00	2			
Physiologist.....	1,800.00			1	Water analysis transferred from sanitary department to Pacific division.
Storemen.....	600.00	1	1	1	
Do.....	450.00	1	3	7	{ Increased fieldwork, checking and storing material and property.
Do.....	360.00			2	
Transitman.....	2,100.00	7	8	5	1 temporary to get data for estimates on Balboa terminals.
Do.....	1,800.00	1	1	4	
Yardmasters.....	2,520.00	3	3	5	{ Account 12-hour day on excavation and concrete work and opening up of work on terminals.
Do.....	2,280.00			4	
Skilled and unskilled labor:					
Apprentices.....	373.20			1	In place of machinist at \$399.
Boatswains.....	660.00			3	{ For new dredge Corozal.
Do.....	540.00	12	16	28	
Boiler makers.....	1,738.00	1	1		
Do.....	1,622.00	6	6	8	Increase at Balboa shops account of unexpected repairs.
Do.....	1,398.00	1	1		
Carpenters.....	499.00	118	278	115	
Do.....	399.00	219	295	407	{ Account of 12-hour day on concrete operations.
Carpenter helpers.....	325.00	42	72	186	
Calkers.....	1,622.00			2	
Do.....	499.00	2	2	6	{ Account of installation of new 20-inch water main.
Do.....	399.00			33	
Calkers' helpers.....	325.00			16	
Cement finishers.....	499.00			11	Instead of cement laborers.
Do.....	399.00		100	92	
Do.....	325.00	33			
Coalmen.....	360.00			10	Instead of laborers.
Concrete men.....	325.00	150		366	Increase instead of cement laborers.
Conductors.....	2,280.00	10	10	14	{ Account 12-hour day on excavation and concrete operations.
Do.....	1,800.00	30	32	53	
Crane operators.....	499.00	1	1	2	Was formerly rated machinist, designation changed to conform to duties.
Drill runners.....	1,680.00	6	6	8	{ Double shift on drill barge and increase of rate in lieu of subsistence.
Do.....	1,500.00			0	
Engineers, station.....	2,700.00			2	1 at Miraflores power house; increase account of standardization of forces and rates of pay of Gatun and Miraflores power houses; 1 at central station of hydraulic excavating plant; increased to standard on similar plants.
Engineers, locomotive (qualified).	2,520.00	10	10	12	Account 12-hour day on excavation and concrete operations.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
PACIFIC DIVISION—contd.					
Skilled and unskilled labor— Continued.					
Engineers, locomotive (unqualified).	\$2,160.00	32	34	58	Account 12-hour day on exca- vation and concrete opera- tions.
Engineers, locomotive (narrow gauge).	1,800.00	15	.....	17	Account 12-hour day on con- crete operations and use of auxiliary plant on Mira- flores concrete.
Firemen.....	601.92	.....	.....	23	Account 12-hour day on exca- vation and concrete opera- tions.
Janitors.....	450.00	2	2	.....	.....
Do.....	360.00	2	2	4	Janitor work transferred from quartermaster's depart- ment.
Do.....	300.00	.....	.....	1	.....
Laborers.....	561.00	375	776	1,104	Account of 12-hour day on excavation and concrete operations. Those under \$561 rate in excess also on account of placing all Euro- pean labor on this basis in- stead of \$449.
Do.....	499.00	455	845	252	.....
Do.....	365.00	355	920	347	.....
Do.....	280.00	437	1,004	172	.....
Laborers, caisson.....	499.00	.....	.....	23	For sinking caissons on Pan- ama R. R. lumber dock and Miraflores north-approach wall.
Laborers, special.....	420.00	.....	.....	13	Special work in connection with hydraulic excavation.
Do.....	360.00	.....	.....	118	See "Pipe-line men" and "Nozzle men," at \$480.
Ladder men.....	900.00	.....	.....	2	For new dredge Corozal.
Nozzle men.....	1,620.00	.....	.....	1	.....
Do.....	1,500.00	.....	.....	2	See "Pipemen."
Do.....	1,350.00	.....	.....	1	.....
Do.....	1,200.00	.....	.....	4	.....
Oilers, electric-crane.....	1,200.00	15	13	10	12-hour day on concrete oper- ations.
Do.....	1,000.00	.....	.....	6	.....
Operators, electric-crane...	2,100.00	17	10	3	.....
Do.....	1,950.00	.....	.....	10	.....
Do.....	1,800.00	3	3	7	Do.
Do.....	1,620.00	4	4	1	.....
Do.....	1,500.00	.....	.....	4	.....
Do.....	1,350.00	.....	.....	1	.....
Recorder, station.....	1,650.00	1	1	.....	.....
Do.....	1,500.00	.....	.....	1	Account of standardizing forces of Gatun and Mira- flores power stations.
Do.....	1,200.00	.....	.....	1	During absence of regular man on leave.
Seamen.....	660.00	1	1	.....	.....
Do.....	600.00	.....	.....	1	.....
Do.....	540.00	9	9	.....	.....
Do.....	480.00	124	134	66	Increases for new dredge Co- roزال.
Do.....	450.00	62	122	23	.....
Do.....	420.00	36	36	19	.....
Do.....	390.00	5	5	22	.....
Do.....	360.00	.....	.....	179	.....
Shoemakers.....	399.00	.....	.....	4	Repairing rubber boots; transferred from quarter- master's department.
Switch tenders.....	325.00	13	13	21	On account of 12-hour day on excavation and concrete operations.
Do.....	250.00	49	61	132	.....

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
PACIFIC DIVISION—contd.					
Skilled and unskilled labor— Continued.					
Telephone operators.....	\$480.00	.....	.....	4	Used as tower men account of extensions and additions to track system.
Do.....	450.00	.....	5	.....	
Do.....	360.00	.....	.....	4	
Trainmen.....	420.00	32	34	25	Account of 12-hour day on ex- cavation and concrete oper- ations.
Do.....	360.00	38	30	57	
Do.....	325.00	.....	.....	43	
Wiremen.....	1,950.00	.....	.....	6	See "Electricians." Increase account 12-hour day on con- crete operations.
Do.....	1,800.00	.....	.....	4	
Do.....	1,650.00	.....	.....	2	
Do.....	1,200.00	1	1	.....	See "Armature winder."
Do.....	1,622.00	1	1	2	
Do.....	499.00	1	1	.....	
Do.....	399.00	3	2	7	Instead of armature winder and linemen.
Wiremen, helpers.....	325.00	8	8	8	
MECHANICAL DIVISION.					
Apprentice.....	374.40	.....	1	5	Transferred from other divi- sions.
Do.....	499.20	.....	.....	1	Promotion in accordance with apprentice scale.
Do.....	624.00	.....	.....	1	Increased equipment repairs.
Blacksmith.....	499.20	5	6	10	
Do.....	624.00	1	2	5	
Do.....	1,397.76	5	2	3	Increased work for other divisions and repairs to equipment.
Do.....	1,622.40	28	30	32	
Blacksmith, tool dresser.....	1,622.40	.....	.....	1	To keep shop tools in condi- tion.
Blacksmith, special.....	1,747.20	.....	1	2	Substitute for man on vaca- tion leave, temporary.
Boilermaker.....	360.00	.....	.....	1	Account hostling; under hostling organization.
Do.....	420.00	.....	.....	1	
Do.....	399.36	111	109	115	Caisson assembling at Cristo- bal.
Do.....	948.00	10	6	25	Account construction work for other divisions and as- sembling of caissons for Cristobal docks.
Do.....	1,098.24	23	21	31	
Do.....	1,397.76	10	7	10	
Do.....	1,622.40	51	46	58	Increased equipment.—Re- pairs and manufacture of structural forms.
Boy.....	124.80	1	.....	7	Increased detail in keeping of shop costs.
Do.....	174.72	3	2	5	
Car repairer.....	399.36	169	147	232	Added car work and substi- tution "silver" men for "gold" which have been below maximum organiza- tion.
Do.....	1,622.40	.....	3	6	Added car work.
Carpenter.....	1,098.24	1	.....	4	Increased equipment repairs, and manufacture from Lirio mill.
Do.....	1,397.76	9	4	6	
Clerk.....	450.00	2	3	6	Increased detail account ad- ditional work by mechan- ical division.
Do.....	510.00	.....	1	3	Account increased detail in keeping of shop costs.
Do.....	1,200.00	.....	.....	2	Account absence of men on vacation leave, temporary.
Do.....	1,800.00	7	7	8	Account increased clerical and pay-roll work on ac- count of increase of force.
Coach cabinetmaker.....	1,622.40	6	3	6	Account transfer coach work to Gorgona shops.
Coach builder and carpenter.....	1,622.40	.....	.....	2	

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
MECHANICAL DIVISION—contd.					
Conductor (unqualified).....	\$1,800.00	.....	.....	1	To handle cars account night force, switching at night.
Coppersmith.....	624.00	.....	.....	1	Increased work for other de- partments.
Do.....	1,622.40	4	2	5	Increased work and reserve men from other divisions.
Draftsman.....	1,650.00	2	2	3	Account establishing of planning department.
Do.....	1,800.00	2	2	4	For planning department and transfer from Panama R. R.
Draftsman, chief.....	2,700.00	.....	.....	1	Account reorganization of drafting office.
Engineer, locomotive (unqual- ified).....	2,160.00	.....	.....	1	Temporary; at Gatun; from hostler.
Engineer, mechanical.....	3,300.00	.....	.....	1	Account reorganization of drafting office.
Engineer, testing, assistant....	1,500.00	.....	.....	1	Oil test, Balboa.
Engineer, testing.....	2,400.00	.....	1	1	Account increased duties.
Foreman.....	1,740.00	.....	.....	2	Changed from leading men;
Do.....	1,800.00	7	11	13	hourly basis, to prevent excessive overtime.
Do.....	1,920.00	.....	.....	5	Do.
Do.....	1,980.00	.....	.....	1	Increased duties of A. sales, account additional equip- ment in use by Pacific divi- sion.
Do.....	2,700.00	6	6	7	Caisson work at Cristobal; lieu of low-grade machin- ists under organization, and reduction of lower- grade gold men.
Helper.....	324.48	447	456	768	Inspection force organized to inspect output of Gorgona shops.
Inspector.....	1,800.00	.....	.....	1	Do.
Do.....	2,100.00	2	2	3	Transferred from other divi- sion.
Ironworker.....	1,397.76	.....	.....	1	Do.
Do.....	1,622.40	.....	.....	1	To properly look after offices.
Janitor.....	450.00	1	2	3	Increased shipping and yard work.
Laborer.....	399.36	6	.....	4	“Cut” trouble man, from 65 cents.
Do.....	499.20	18	26	54	Increased output finished castings, erection for other divisions, and equipment repairs. Reserve men for other divisions.
Lineman.....	1,800.00	1	1	2	Increased foundry output; lock castings.
Machinist.....	1,397.76	18	10	19	Lieu of 1 cupola tender; same rate.
Do.....	1,622.40	187	201	298	Castings for locks and estab- lishing of steel foundry.
Molder.....	399.36	43	30	42	Construction lock model.
Do.....	1,397.76	.....	.....	1	Change of rating from sta- tionary engineers at similar rates under organization.
Do.....	1,622.40	50	38	53	Account added car and coach work.
Model maker.....	2,100.00	.....	.....	1	Do.
Oiler.....	360.00	.....	.....	4	Do.
Do.....	420.00	7	4	7	Account transfer of coach work to Gorgona.
Do.....	540.00	.....	.....	1	
Do.....	480.00	.....	.....	1	
Do.....	720.00	1	.....	1	
Painter.....	399.36	16	17	20	
Do.....	624.00	.....	.....	4	
Do.....	1,093.24	3	.....	1	
Do.....	1,622.40	.....	.....	4	

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHAIRMAN AND CHIEF ENGINEER—Contd.					
MECHANICAL DIVISION—contd.					
Pattern maker.....	\$1,872.00	15	9	10	Account increased foundry output and installation of steel foundry.
Pipe fitter.....	1,747.20			1	Leading man.
Planing-mill hand.....	499.20			7	Increased car work and general manufacture transferred from Lirio mill—abolished.
Do.....	1,397.76	14	8	12	Do.
Rigger.....	324.48			2	Changed designation of laborers.
Steam fitter.....	1,622.40			2	Transferred from Gatun.
Superintendent, electrical.....	3,300.00			1	Increased duties and responsibility. Salary increased.
Trainman.....	360.00	4		3	} Account establishing night switching crew.
Do.....	420.00		2	4	
Typewriter repairer.....	1,500.00	2	2	3	One added to handle adding machines.

DEPARTMENT OF CIVIL ADMINISTRATION.

Executive office:					
Clerk.....	\$1,200.00			1	Temporary appointment, 2 months, effective Apr. 29, 1912; account resignation of clerk entering on 70 days' leave.
Do.....	900.00	1	1	2	Temporary appointment, 6 weeks, effective May 27, 1912; account regular telephone operator on leave.
Census expert.....	3,600.00			1	Temporary appointment, 7 months, effective Nov. 22, 1911; to direct taking of 1912 Zone census.
Do.....	2,400.00			1	Temporary appointment, 2 months, effective Dec. 12, 1911; to assist supervision of 1912 Zone census.
Board of local inspectors:					
Assistant boiler and hull inspector.	2,100.00			1	Appointed, effective Dec. 11, 1911; account additional duties assigned to board of local inspectors under Executive order of President, of July 21, 1911, "Providing for the inspection of steam vessels."
Division of revenues:					
Clerk.....	1,800.00	3	3	4	Through a rearrangement of work; 1 clerk at \$125 and 1 inspector at \$100 were dropped and 1 clerk at \$150 added; effective Sept. 16, 1911.
Do.....	600.00	1	1	2	1 appointed, effective Mar. 5, 1912, account additional work under Executive order of President of Feb. 5, 1912, re administration of estates in Canal Zone.
Road supervisors.....	600.00			2	Temporary, 2 months, effective May 4, 1912; to warn persons liable for poll tax to work at stated time or pay tax.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CIVIL ADMINISTRATION—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
Division of revenues—Contd.					
Postal clerk.....	\$1,500.00	29	29	30	Substitution of 2 postal clerks at \$1,500 in place of 2 postmasters at \$1,500; effective June 21, 1912, 2 post offices having been discontinued.
Do.....	1,200.00			1	Temporary, 3 months, effective Apr. 21, 1912; account resignation of clerk entering on 84 days' leave.
Clerk.....	900.00	2	2	6	A total of 9 were employed during the year. Temporary appointment of 1 for 6 weeks, effective July 20, 1911, account large number clerks sick, on leave, and about to enter on leave. Temporary appointment of 4 for 30 days, effective Dec. 9, 1911, to help handle Christmas mail. 2 appointed, effective May 17, 1912, account increased work due to postal savings system.
Do.....	720.00			1	Appointed, effective Feb. 1, 1912, in place of messenger at \$450, account increased work at Balboa post office due to fortification work. The net increase is chargeable to fortification work.
Inspector of post offices....	2,100.00			1	This position (created Apr. 13, 1911) increased, effective June 1, 1912, from \$1,800 to \$2,100, account increased duties resulting from establishment of postal savings system.
Postmaster.....	300.00			2	Effective Apr. 22, 1912, station agents at Monte Lirio and Frijoles designated as postmasters.
Do.....	900.00			5	2 postmasters (Toro Point and Porto Bello) increased, effective July 1, 1911, from \$600 to \$900, as offices were made money-order stations. Effective Mar. 14, 1912; authorized maximum pay of postmaster (Matachin) reduced from \$1,000 to \$900.
Do.....	2,000.00			1	Increase in pay of postmaster (Gorgona), effective Aug. 1, 1911, from \$1,900 to \$2,000, account increased postal receipts.
Do.....	2,400.00	1	1	2	Increase in pay of postmaster (Gatun), effective Aug. 1, 1911, from \$2,300 to \$2,400, account increased postal receipts.
Do.....	2,700.00			1	Increase in pay of postmaster (Cristobal), effective Aug. 1, 1911, from \$2,600 to \$2,700, account increased postal receipts.
Division of fire protection: Engineer, motor.....	1,800.00			1	Substituted in place of 1 fireman at \$1,500, effective May 4, 1912, to operate new automobile fire engine.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF CIVIL ADMINISTRATION—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
Division of public works: Pipefitter (20 cents).....	\$547. 20	1	1	2	Substituted, effective June 8, 1912, in place of 1 mason at 20 cents, account class of work performed by incumbent.
Judiciary: Translator.....	1,800. 00	1	1	2	One temporary appointment, 2 months, effective Mar. 8, 1912, during unavoidable absence of 2 regular court translators.
Government of the Canal Zone (division of schools): Principal, grammar school.	990. 00	5	5	7	Increase of 1, effective Oct. 4, 1911, in place of teacher at \$810; to provide increase in pay for teacher in charge of Pedro Miguel break to agree with pay of similar positions elsewhere. Increase of 1, effective Feb. 26, 1912, in place of teacher at \$810; to provide increase in pay for teacher at Ancon, account increased duties.
Teacher.....	810. 00	24	24	33	One appointed, effective Oct. 11, 1911, for white schools established at Porto Bello. Two appointed, effective Oct. 18, 1911, account increased attendance at Gatun and Gorgona white schools.
Do.....	540. 00	12	12	16	Two appointed, effective Oct. 26, 1911, for new colored school at Ancon. Two appointed effective Dec. 30, 1911, account increased attendance at Ancon and Cristobal colored schools.
Gardener (per month).....	30. 00	.....	.....	1	Temporary, 3 months, effective July 1, 1911; to care for school gardens during vacation.

DEPARTMENT OF SANITATION.

OFFICE OF THE CHIEF SANITARY OFFICER.					
Officers and employees:					
Chaplain.....	\$1,200. 00	5	4	5	1 additional chaplain at \$1,200 was authorized and appointed after the 1912 estimate had been submitted.
Clerk.....	1,500. 00	4	4	5	1 clerk temporarily filling vacancy of \$125 storekeeper; authority for department not exceeded.

NOTE.—Where explanations of increases do not properly account for the differences between figures in the fifth column and those in the fourth column, the figures are reconciled by the increases authorized during the fiscal year 1911, shown in the statement forwarded with Mr. Thatcher's letter of June 18, 1911, in response to the chairman's letter of June 14, 1911, and the organization data therein contained.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF SANITATION—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF THE CHIEF SANITARY OFFICER—Continued.					
Officers and employees—Con.					
Messenger.....	\$360.00	-----	2	2	Messengers were employed at entrance salary provided in Circular 229 and promoted. The organization of July 1, 1910, is based upon rolls at that time, two men serving at entrance salary. Impossible to retain good men at entrance salary.
Nurse.....	1,260.00	1	1	2	Male nurse transferred from line station; temporarily filled vacancy of \$125 storekeeper; authority for department not exceeded.
Physician.....	1,800.00	-----	-----	1	Carried temporarily on chief sanitary office roll while on detached duty. Authority for department not exceeded.
Skilled and unskilled labor:					
Engineer, marine.....	1,740.00	-----	-----	2	Engineer on Sanidad at \$135 was discharged for incompetence and it was impossible to secure licensed engineer to fill his place for less than \$145. Additional engineer was employed for 6 weeks while regular engineer was on vacation.
Do.....	1,980.00	-----	-----	1	Employed for 12 weeks while mate of Sanidad was on vacation.
ANCON HOSPITAL.					
Officers and employees:					
Chaplain (in addition to Army pay of \$3,600).	1,200.00	-----	-----	1	Transferred from office of chief sanitary officer, Sept. 5, 1911, vice a \$1,200 chaplain resigned; regular \$1,200 position abolished.
Clerk.....	1,500.00	5	5	6	Temporary relief during vacation; authority for department not exceeded.
Foreman.....	1,800.00	-----	-----	1	Position of 1 foreman at \$125 and 1 engineer at \$50 in the laundry abolished and one foreman at \$150 substituted.
Do.....	1,500.00	1	1	2	One additional foreman at \$125 employed account of 35 per cent increase in amount of work done at laundry; later abolished. (See preceding item.)
Interne.....	1,200.00	-----	-----	5	Temporary appointments filling \$150 physicians' vacancies.
Laboratory assistant.....	1,260.00	2	2	3	The \$90 man was promoted at end of 6 months satisfactory service as per conditions of employment.
Messenger.....	210.00	-----	-----	3	Three at \$210 per month authorized May 16, 1912, to take place of one at \$150 and two at \$120, account impossibility to retain efficient help at lower rates.
Nurse, male.....	1,260.00	8	8	11	Increase of 3 to take place of female nurses in venereal wards; authority for female nurses reduced by 3.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF SANITATION—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHIEF SANITARY OFFICER—Continued.					
ANCON HOSPITAL—continued.					
Officers and employees—Con.					
Physician.....	\$3,600.00	1	1	2	Due to change of station, etc.; authority for department not exceeded.
Do.....	3,000.00	2	2	4	Do.
Do.....	2,400.00	8	8	11	Do.
Watchman.....	300.00	1	1	1	Employed to afford better protection at night to hos- pital property.
Skilled and unskilled labor:					
Carpenter.....	499.00	1	1	3	2 additional authorized dur- ing absence of one of these \$1,750 men, who has been on sick report 6 months.
Helper, druggist.....	300.00			1	Rating changed from attend- ant, at \$300, to conform to duties.
Laundryman.....	360.00	3	3	4	On Jan. 23, 1912, an addi- tional laundryman, at \$360 was authorized to take the place of 2 laundresses, at \$180 each.
Laborer.....	324.00			7	10 men at this rate authorized temporarily in place of 10- cent men to do grass cut- ting.
Maid.....	144.00	24	24	26	3 additional maids author- ized May 16, 1912, account increase in number of women patients.
Plumber.....	799.00			1	Promoted Oct. 1, 1910, from helper (plumber) at 25 cents to plumber at 32 cents account efficiency, length of service, and expe- rience in this position.
Telephone operator.....	360.00			1	1 additional authorized Oct. 6, 1911, in order to change their day from 12 to 8 hours.
COLON HOSPITAL.					
Officers and employees:					
Attendant.....	180.00	30	34	44	10 additional authorized Aug. 18, 1910, account increased number of patients in hos- pital.
Druggist.....	1,500.00	1	1	2	1 druggist transferred tempo- rarily during vacation; au- thority for department not exceeded.
Dietist.....	1,200.00			1	Is in 1912 Book of Estimates as nurse, special, at \$1,200; account increased number of patients, this position was restored to same status as prior to January, 1909; authority for \$900 de- creased by 1.
Interne.....	1,200.00			3	Temporary appointments to fill \$150 physicians' vacan- cies.
Messengers.....	300.00		2	2	Authorized Aug. 18, 1910, to do work formerly done by attendants.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF SANITATION—Continued.

Designation.	Rate of pay.	Organization of July 1, 1910.	Number allowed in 1912 Book of Estimates.	Maximum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHIEF SANITARY OFFICER—Continued.					
COLON HOSPITAL—continued.					
Officers and employees—Con.					
Physician.....	\$2,400.00	2	2	8	Due to transfers, etc.; authority for department not exceeded.
Storekeeper.....	1,500.00	1	1	2	1 storekeeper transferred temporarily during vacation; authority for department not exceeded.
Skilled and unskilled labor:					
Janitor.....	240.00		2	2	Authorized Aug. 18, 1910, to do work formerly done by attendants.
Maid.....	144.00	13	25	26	1 additional employed for 20 days in August, 1911, in an emergency.
Plumber.....	799.00			1	Temporary transfer from Ancon Hospital; authority for department not exceeded.
LINE HOSPITALS.					
Officers and employees:					
Attendant.....	540.00		1	1	Foreman at Palo Seco at \$450 changed to attendant at \$540, to comply with nature of duties. Promoted account excellent services (surgical dressing of lepers) rendered.
Do.....	180.00	25	25	26	Force at Palo Seco increased by 1, account increase in number of patients from 30 to 42.
Clerk.....	1,800.00			1	Temporary detail during vacation; authority for department not exceeded.
Do.....	1,500.00	3	3	4	Position of clerk at \$1,500 substituted for druggist at \$1,500 at Taboga Sanitarium to conform with nature of duties.
Druggist.....	1,200.00	3	3	4	1 \$900 druggist at Empire promoted to \$1,200 to equalize pay with other stations of equal amount of work.
Housekeeper.....	600.00			1	Position substituted for 1 \$720 nurse at Taboga Sanitarium.
Nurse, male.....	1,500.00	1	1	2	1 transferred temporarily from Ancon Hospital to relieve superintendent of Palo Seco while on vacation; authority for department not exceeded.
Nurse, male.....	1,260.00	19	19	21	The \$90 men were promoted at end of 6 months' satisfactory service as per conditions of employment.
Physician.....	3,000.00	3	3	4	Due to transfer; authority for department not exceeded.
Skilled and unskilled labor:					
Cook.....	720.00			1	Cook at Taboga Sanitarium promoted account of increased duties.
Firemen.....	120.00			2	Authorized Apr. 1, 1912, for the pumping plant at Palo Seco.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF SANITATION—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHIEF SANITARY OFFICER—Continued.					
HEALTH OFFICE, PANAMA.					
Officers and employees:					
Clerk.....	\$81,500.00	.....	1	2	Authorized at \$150 but not yet paid; 1 clerk transferred temporarily during vacation; authority for department not exceeded.
Inspector, sanitary.....	1,500.00	4	4	5	Substituted for sanitary inspector at \$1,200, as \$1,500 is minimum paid for this position in all other divisions.
Physician.....	2,400.00	.....	.....	1	Had been substituting for assistant health officer while latter was health officer of Colon; carried on this roll while on vacation; authority for department not exceeded.
Skilled and unskilled labor:					
Laborer.....	250.00	35	35	42	10 additional authorized for 20 days, Nov. 2, 1910, account of ditching and cleaning on Isthmian Canal Commission land on Balboa Road; 15 authorized for 3 weeks, Feb. 23, 1911, account of ditching and brushing in swamps east of Maranon and Trujillo and north of Caledonia, City of Panama.
HEALTH OFFICE, COLON AND CRISTOBAL.					
Officers and employees:					
Clerk.....	900.00	.....	.....	2	1 filling regular \$1,500 position; 1 employed temporarily during vacation of regular incumbent; authority for department not exceeded.
QUARANTINE.					
Officers and employees:					
Attendant.....	360.00	.....	.....	1	Transferred from line hospitals to quarantine (Colon) in November, 1911.
Do.....	300.00	2	2	3	1 additional employed at Culebra Island quarantine station, October, 1911.
Custodian.....	1,800.00	.....	.....	1	1 custodian's rating changed from \$125 with subsistence to \$150 without subsistence.
Physician.....	2,400.00	.....	.....	1	Temporary detail during vacation of quarantine officer; physicians' authority for department not exceeded.
Do.....	1,800.00	.....	.....	2	Temporary details during vacation of quarantine officer; physicians' authority for department not exceeded.
Watchman.....	240.00	2	1	2	1 additional authorized for duty at Colon station. Should have been in 1912 Book of Estimates.
Skilled and unskilled labor:					
Cook.....	540.00	.....	.....	1	Increased from \$480 in order to retain satisfactory men at isolated station.

Tables showing increases in salaries authorized over organization of July 1, 1910—Con.

DEPARTMENT OF SANITATION—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
OFFICE OF CHIEF SANITARY OFFICER—Continued.					
QUARANTINE—continued.					
Skilled and unskilled labor— Continued.					
Carpenter.....	\$399.00	.....	.....	1	On Oct. 12, 1911, the position of carpenter at \$60 per month was abolished and 1 at 16 cents per hour substituted.
Matron.....	600.00	.....	.....	1	Rating changed from \$25 with subsistence to \$50 without subsistence.
ZONE SANITATION.					
Officers and employees:					
Clerk.....	1,800.00	.....	.....	1	\$125 man promoted; total number of \$150 clerks within department not exceeded.
Messenger.....	210.00	8	8	9	1 additional employed account of impossibility to get a boy at \$125 to fill vacancy in that grade; \$210 is lowest rating for messenger in Circular 229.
Skilled and unskilled labor:					
Laborer.....	250.00	206	206	252	The force was this high for only 1 month, August, 1911, account of the increase in amount of mosquito oiling required in the rainy season. During the dry season the force was reduced to as low as 164 men. The average for the 12 months of the fiscal year was less than 206.

QUARTERMASTER'S DEPARTMENT.

Officers and employees:					
Clerks.....	\$450.00	7	7	8	Reduced from \$600 per annum.
Do.....	750.00	4	4	8	2 increased from \$720 per annum; 2 additional; increased work.
Clerk.....	900.00	12	12	14	Reduced from \$1,200 per annum.
Do.....	1,650.00	12	12	20	7 positions increased from \$1,500 account increased work; 1 designation changed from timekeeper.
Do.....	1,800.00	12	12	13	Reduced from \$2,100 per annum.
Foreman.....	1,650.00	4	4	12	Increased work in these positions.
Do.....	1,800.00	6	6	7	Reduced from \$1,980.
Inspector.....	2,400.00	1	.....	1	In lieu of \$3,000 place.
Quartermaster, assistant district.	1,800.00	4	4	5	Designation changed from district quartermaster.

NOTE.—The department's authority for physicians is 101: 33, at \$3,000 or more; 34, at \$2,400; and 34, at \$1,800. These men are transferred from one station to another as conditions require, thus accounting for the apparent excess at some stations, while in fact there are never more on the pay rolls than the total number authorized in each grade.

At some stations there is but 1 employee doing a certain class of work who must be relieved while on vacation, or sick leave, by a temporary transfer of another employee from some other division of the department. This creates an excess in the particular division for the time being, but the total number of employees of each class on the pay rolls of the department is not exceeded.

Tables showing increases in salaries authorized over organization of July 1, 1910—Con.

QUARTERMASTER'S DEPARTMENT—Continued.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
Officers and employees—Contd.					
Quartermaster, district	\$2,400.00	3	3	4	Increased work at Pedro Miguel.
Storekeeper	1,800.00	-----	-----	1	Reduced from \$2,100 per annum.
Storeman	300.00	3	3	13	In lieu of foremen at a like wage.
Do	450.00	16	15	18	In lieu of foreman at the same rate of pay. See reduction in foremen positions of \$900, \$750, \$600, and \$450 per annum.
Do	360.00	17	15	23	
Do	600.00	14	12	21	
Watchman	360.00	-----	-----	1	In lieu of \$450 per annum.
Skilled and unskilled labor:					
Artisan	399.00	5	5	10	5 pressmen designation changed to artisan, same rate, in order to make them available for any service.
Do	499.00	7	7	8	1 compositor; same reason as above.
Do	624.00	2	2	6	3 compositors and 1 pressman; designation changed for same reason shown above.
Blacksmith	399.00	1	1	2	Increased work at Mount Hope depot.
Do	600.00	5	5	7	Cut out 2 positions at \$540 and increased 2 positions from \$540 to \$600, making a saving of \$960 per annum.
Boy	173.00	3	3	4	1 additional position required at Dock 14.
Carpenter	499.00	47	40	47	When estimate was prepared it was thought practicable to reduce force of carpenters, but this has been found impracticable up to the present time, due to slides at Culebra and transferring quarters from Balboa, account construction of dry dock, shops, etc.
Do	624.00	85	70	85	
Craneman	600.00	2	2	3	In lieu of \$1,500 place.
Farrier	600.00	2	2	5	Increased from \$480 to \$600 on account of reduction of stablemen, thus increasing work of farriers.
Fireman	450.00	7	7	9	Reduced from \$600 per annum.
Laborer	325.00	14	14	76	Necessary in order to hold laborers on dock.
Do	399.00	70	50	261	Reduced from \$499.
Operator, monotype	1,800.00	-----	-----	1	Increased from \$1,500 to \$1,800 in order to secure competent man; was found impracticable to hold man at \$1,500 rate.
Painters	624.00	41	25	41	When estimate was prepared it was thought the \$624 employees of this class could be materially reduced, but this was found impracticable; however, the total number has been reduced by 9.
Plumber	624.00	7	7	10	In order to hold good colored plumbers it is necessary to pay this increased wage.
Do	1,617.20	-----	-----	1	These additional positions are temporary owing to work of moving quarters from Balboa and account of United States troops.
Do	1,872.00	8	8	9	

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

QUARTERMASTER'S DEPARTMENT—Continued.

Designation.	Rate of pay.	Organization of July 1, 1910.	Number allowed in 1912 Book of Estimates.	Maximum number employed at any one time during fiscal year 1912.	Explanation of increase.
Skilled and unskilled labor—Continued.					
Rigger.....	\$365.00	4	4	6	These men employed at a monthly rate in lieu of an hourly basis where they were getting excessive overtime.
Pressman.....	499.00	7	7	10	1 position reduced from \$624; 2 positions increased, owing to getting a better class of men.
Teamster.....	480.00	41	41	49	In order to secure better teamsters, thereby making a large reduction in \$420 positions.
Trucker.....	300.00			9	In lieu of laborers, in order to eliminate overtime.
Upholsterer.....	399.00	3	3	4	Reduced from \$499.
Wheelwright.....	600.00	3	3	4	In lieu of \$1,500 per annum.

SUBSISTENCE DEPARTMENT.

Head waiter.....	\$900.00			1	Account increase of work at Tivoli.
Messenger.....	300.00	2	2	3	Increase 1 messenger at \$300, 1 at \$450, covered by a decrease of 2 at \$210, 3 at \$360; total decrease, \$750.
Do.....	450.00		3	4	
Steward.....	600.00	7	2	2	Increase 1 steward at \$600, 6 at \$1,200, 2 at \$1,500, covered by decrease of 1 at \$450, 2 at \$720, 1 at \$750, 2 at \$1,800, 2 at \$2,100; total increase \$360, account employment of men on gold roll in place of those on silver roll.
Do.....	1,200.00	7	6	12	
Do.....	1,500.00	4	6	8	
Storeman.....	300.00	3	6	9	Increase 3 storemen at \$300, 2 at \$450, covered by decrease of 1 at \$600, and 1 storekeeper at \$720, 1 at \$900, 1 at \$1,000; total decrease, \$1,420.
Do.....	450.00	2	2	4	
Boy.....	120.00		10	13	Increase of 3 boys at \$120 covered by decrease of 2 at \$150, 2 at \$180; total decrease, \$300.
Cook.....	420.00	2	5	7	Increase 2 cooks at \$420 covered by decrease of 25 at \$240, 11 at \$300, 5 at \$360, 6 at \$450, 2 at \$480, 8 at \$540, 8 at \$600, 4 at \$720, 4 at \$900, 2 at \$1,000; total decrease, \$31,520.
Helper.....	150.00		230	275	Increase 45 helpers at \$150, 44 at \$120, 2 at \$300, covered by decrease of 36 at \$180, 28 at \$210; total decrease, \$330
Do.....	120.00			44	
Do.....	300.00	40		2	
Janitor.....	210.00	18	16	18	Increase 2 janitors at \$210 covered by decrease of 1 at \$300, 2 at \$360, 1 at \$450; total decrease, \$1,050.
Maid.....	210.00	17	16	18	Account increase of work at Hotel Tivoli.
Waiter.....	180.00	141	150	202	Increase of 52 waiters at \$180, 1 at \$450, covered by decrease of 65 at \$210, 11 at \$240, 10 at \$300, 1 at \$360; total decrease, \$9,840.
Waiter, head.....	450.00	6	2	3	

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

DEPARTMENT OF EXAMINATION OF ACCOUNTS.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
Claim officer.....	\$2,700.00	.....	1	1	Salary increased from \$2,400 on account of increased duties and responsibilities under sec. 5, act of Mar. 4, 1911, transferring to chairman the duty of settling claims for compensation on account of injury and death previously vested in Secretary of Commerce and Labor.
Clerk.....	2,100.00	4	4	5	The salary of 1 clerk in injury claims division increased from \$1,800 to \$2,100, due to reasons stated opposite claim officer.

DEPARTMENT OF LAW.

Counsel and chief attorney (head of department of law).	\$7,200.00	\$5,000.00	\$5,000.00	(1)	Items 1, 2, and 3 increase on account of additional and more important duties by reason of the change of office from a division to a department and by the consolidation of the land offices of the commission and Panama R. R. under department of law.
Prosecuting attorney.....	3,600.00	3,000.00	3,000.00	(2)	
Assistant prosecuting attorney.	3,000.00	2,400.00	2,400.00	(3)	Duties of place made those of combined file clerk and stenographer.
Clerk.....	1,800.00	1,500.00	1,500.00	(4)	
Land agent.....	3,300.00	.....	.....	3,300.00	Added to force with consolidation of Isthmian Canal Commission and Panama R. R. land offices under department of law. (See chairman's letter of May 19, 1911.)
Clerk.....	1,920.00	.....	.....	1,920.00	Same as item 5.
Inspector.....	1,200.00	.....	.....	1,200.00	Do.
Clerk.....	510.00	.....	.....	510.00	Do.
Messenger.....	300.00	240.00	300.00	300.00	Increased work of office.

¹ \$6,000 rate from July 1, 1911, to Dec. 31, 1911; \$7,200 rate from Jan. 1, 1912, to June 30, 1912.

² \$3,000 rate from July 1, 1911, to Dec. 31, 1911; \$3,600 rate from Jan. 1, 1912, to June 30, 1912.

³ \$2,400 rate from July 1, 1911, to Dec. 31, 1911; \$3,000 rate from Jan. 1, 1912, to June 30, 1912.

⁴ \$1,500 rate from July 1, 1911, to July 31, 1911; \$1,800 rate from Aug. 1, 1911, to June 30, 1912.

Tables showing increases in salaries authorized over organization of July 1, 1910—Contd.

WASHINGTON OFFICE.

Designation.	Rate of pay.	Organi- zation of July 1, 1910.	Number allowed in 1912 Book of Esti- mates.	Maxi- mum number employed at any one time during fiscal year 1912.	Explanation of increase.
Purchasing department:					
Clerk, New Orleans office..	\$1,500.00	-----	1	1	{ Increased Oct. 1, 1910, from \$1,400 to \$1,500 on account of increased duties.
Do.....	1,400.00	1	-----	-----	
Disbursing office:					
Clerk.....	1,400.00	4	4	5	On account of increased work in disbursing office one position was transferred from administration office, thus causing no increase in Washington office force as a whole.
Examination of accounts:					
Clerk.....	1,400.00	2	2	3	On account of increased duties and responsibilities of a clerk in the examina- tion of accounts, a \$1,200 position of that office was exchanged for a \$1,400 posi- tion in the administrative office on May 1, 1912, the clerk being promoted from \$1,200 to \$1,400, no increase being caused in the Wash- ington office force as a whole.
Special force for preparation of data on Panama Canal traf- fic and tolls and the meas- urement of vessels:					
Special commissioner.....	¹ 15.00	-----	-----	1	{ A temporary force engaged upon the preparation of special data for the Secre- tary of War and Congress.
Statistician.....	2,160.00	-----	-----	1	
Clerk.....	1,000.00	-----	-----	1	

¹ Per day and expenses. Entire compensation to be fixed upon completion of work.



APPENDIX T.

ACTS OF CONGRESS AFFECTING THE ISTHMIAN CANAL AND EXECUTIVE ORDERS RELATING TO THE CANAL ZONE.

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APPENDIX T.

ACTS OF CONGRESS AFFECTING THE ISTHMIAN CANAL AND EXECUTIVE ORDERS RELATING TO THE CANAL ZONE.

AN ACT Limiting the hours of daily service of laborers and mechanics employed upon work done for the United States, or for any Territory, or for the District of Columbia, and for other purposes.

* * * * *

The President, by Executive order, may waive the provisions and stipulations in this Act as to any specific contract or contracts during time of war or at a time when war is imminent, and until January first, nineteen hundred and fifteen, as to any contract or contracts entered into in connection with the construction of the Isthmian Canal.

* * * * *

Approved, June 19, 1912.

[Extract from the act of Congress entitled "An Act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and thirteen, and for other purposes."]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending June thirtieth, nineteen hundred and thirteen, namely:

* * * * *

THE ISTHMIAN CANAL.

To continue the construction of the Isthmian Canal, to be expended under the direction of the President, in accordance with an Act entitled "An Act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific Oceans," approved June twenty-eighth, nineteen hundred and two, and Acts amendatory thereof or supplementary thereto:

First. For salaries of officers and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States, \$150,000.

Second. For incidental expenses, including rents, cable and telegraph service, supplies, stationery and printing, and actual necessary traveling expenses in the United States (including rent of the Panama Canal building in the District of Columbia, \$7,500, textbooks and books of reference, \$1,000, and additional compensation to the Auditor for the War Department for extra services in auditing accounts of the Isthmian Canal, \$1,000), \$50,000.

Third. For pay of members of the commission and officers and employees on the Isthmus, other than skilled and unskilled labor, including civil engineers, superintendents, instrumentmen, transitmen, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, quartermasters, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, wagon masters, watchmen, and stewards, including those temporarily detailed for duty away from the Isthmus, in the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, and for those employed in connection with the preservation of plans, drawings, and other records, \$3,000,000: *Provided*, That not more than \$5,000 of this appropriation shall be paid as compensation to the secretary of the commission.

Fourth. For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, black-

smiths, and other artisans, and their helpers; janitors, sailors, cooks, waiters, and dairy-men, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, \$11,000,000.

Fifth. For purchase and delivery of material, supplies, and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the commission deems necessary to best promote the construction of the Isthmian Canal, including not exceeding \$50,000 for the payment of damages caused to the owners of private lands, or private property of any kind, by reason of the grants contained in the treaty between the United States and the Republic of Panama proclaimed February twenty-sixth, nineteen hundred and four, or by reason of the operations of the United States, its agents or employees, or by reason of the construction, maintenance, operation, sanitation, and protection of the said canal or of the works of sanitation and protection therein provided for, which may be compromised by agreement between the claimant and the chairman of the commission without the intervention of a joint commission, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, and for a permanent administration building, \$12,000,000.

Sixth. For miscellaneous expenditures, cable and telegraph service, stationery and printing, local railway transportation, special trains, including pay-train service; transportation of currency to the Isthmus, recruiting and transporting laborers, transporting employees from the United States, repatriating laborers and employees, actual necessary traveling expenses while on the Isthmus on official business; expenses incident to conducting hearings and examining estimates for appropriations of the Isthmus, and all other incidental and contingent expenses not otherwise provided for, for the departments of construction and engineering, quartermaster's, subsistence, disbursements and examination of accounts, \$790,000.

Seventh. For pay of the member of the commission in charge of the department of civil administration, of officers and employees, other than skilled and unskilled labor, including foremen, subforemen, watchmen, messengers, and storekeepers, of the departments of civil administration and law, including those necessarily and temporarily detailed for duty away from the Isthmus, \$500,000;

Eighth. For skilled and unskilled labor for the department of civil administration, \$15,000;

Ninth. For material, supplies, equipment, construction and repairs of buildings, and contingent expenses of the departments of civil administration and law, including not exceeding \$500 for law books, \$75,000.

Tenth. For pay of the member of the commission in charge, of officers and employees other than skilled and unskilled labor, including hospital dispensers, internes, nurses, attendants, messengers, office boys, foremen and subforemen, watchmen, and stewards, of the department of sanitation on the Isthmus, including those temporarily detailed for duty away from the Isthmus, \$700,000.

Eleventh. For skilled and unskilled labor of every grade and kind, for the department of sanitation on the Isthmus, \$200,000;

Twelfth. For material, supplies, equipment, construction and repairs of buildings, medical aid and support of the insane, and of indigent persons permanently disabled, while in the line of duty and in the employ of the Isthmian Canal Commission, from earning a livelihood, and contingent expenses of the department of sanitation on the Isthmus, \$500,000: *Provided*, That no part of this appropriation shall be used for or toward the construction of a new quarantine station.

The foregoing sums, so far as necessary, shall be available for necessary dry dock, coaling plant, shops, and other facilities for repairing and supplying vessels and necessary wharves, sheds, and other terminal facilities, and for the consolidation and preservation of the files of papers and other records which have accumulated or may accumulate during the construction of the canal and needed or useful or having a permanent value or historical interest, as may be determined by the chairman of the Isthmian Canal Commission.

In all, \$28,980,000, the same to be immediately available and to continue available until expended: *Provided*, That all expenditures from the appropriations heretofore, herein, and hereafter made for the construction of the Isthmian Canal, including any portion of such appropriations which may be used for the construction of the necessary dry dock, coaling plant, shops, and other facilities for repairing and supplying vessels, and all necessary wharves, sheds, and other terminal facilities, exclusive of fortifications, shall be paid from or reimbursed to the Treasury of the United States out of the proceeds of the sale of bonds authorized in section eight of the said Act approved June twenty-eighth, nineteen hundred and two, and section thirty-nine of the tariff Act approved August fifth, nineteen hundred and nine.

Except in cases of emergency, or conditions arising subsequent to and unforeseen at the time of the passage of this Act, there shall not be employed at any time during the fiscal year nineteen hundred and thirteen under any of the foregoing appropriations for the Isthmian Canal, any greater number of persons than are specified in the notes submitted respectively in connection with the estimates for each of said appropriations in the annual Book of Estimates for said year, nor shall there be paid to any of such persons during that fiscal year any greater rate of compensation than was authorized to be paid to persons occupying the same or like positions on the first day of July, nineteen hundred and ten, and all employments made or compensation increased because of emergencies or conditions so arising shall be specifically set forth, with the reasons therefor, by the chairman of the commission in his report for the fiscal year nineteen hundred and thirteen.

In cases of emergencies arising subsequent to and unforeseen at the time of submitting the annual estimates to Congress, ten per centum of the foregoing amounts shall be available interchangeably for expenditure on objects named; but not more than ten per centum shall be added to any one item of the appropriation.

No part of the foregoing appropriations for the Isthmian Canal shall be applied to the payment of allowances for longevity service, or lay-over days other than such as may have accumulated under existing orders of the commission, prior to July first, nineteen hundred and nine.

FORTIFICATIONS, ISTHMIAN CANAL.

For the following for fortifications and armament thereof for the Isthmian Canal, to be immediately available and to continue available until expended, namely:

Surveys: For detailed surveys of the areas on the Canal Zone required for military purposes, including the cost of marking permanently the boundaries of such areas, \$50,000;

Causeway: For the construction of a causeway or bridge for use in connection with fortifications, Isthmian Canal, \$150,000;

Seacoast batteries: For construction of seacoast batteries on the Canal Zone, \$1,000,000, and any balances of the appropriation for the construction of seacoast batteries on the Canal Zone made by the Act of March fourth, nineteen hundred and eleven;

Submarine mine structures: For the construction of mining casemates, cable galleries, torpedo storehouses, cable tanks, and other structures necessary for the operation, preservation, and care of submarine mines and their accessories on the Canal Zone, \$220,200;

Field fortifications and camps: For the construction of field fortifications and the preparation of camp sites on the Canal Zone, \$200,000;

Armament of fortifications: For the purchase, manufacture, and test of seacoast cannon for coast defense, including their carriages, sights, implements, equipments, and the machinery necessary for the manufacture at the arsenals, to cost ultimately not to exceed \$2,324,000, \$500,000;

For the purchase, manufacture, and test of ammunition for seacoast cannon, including the necessary experiments in connection therewith, and the machinery necessary for its manufacture at the arsenals, \$575,000;

Submarine mines: For the purchase of submarine mines and the necessary appliances to operate them for closing the channels leading to the Isthmian Canal, \$111,750;

In all, specifically for fortifications and armament thereof for the Isthmian Canal, \$2,806,950.

SEC. 2. All funds collected by the government of the Canal Zone from rentals of public lands and buildings in the Canal Zone and the cities of Panama and Colon, and from the zone postal service, and from court fees and fines, and collected or raised by taxation in whatever form under the laws of the government of the Canal Zone, are hereby appropriated until and including June thirtieth, nineteen hundred and thirteen, as follows: The revenues derived from the postal service to the maintenance of that service; the remaining revenues, including any balances unexpended in prior years, after setting aside a miscellaneous and contingent fund of not exceeding ten thousand dollars, to the maintenance of the public-school system in the zone; to the construction and maintenance of public improvements within the zone; to the maintenance of the administrative districts; to the maintenance of Canal Zone charity patients in the hospitals of the Isthmian Canal Commission, and to the maintenance of administrative district prisoners. A detailed and classified statement of all receipts and expenditures without the duplication of items under this paragraph shall be submitted to Congress after the close of the fiscal year nineteen hundred and thirteen.

SEC. 3. All funds realized during the fiscal year nineteen hundred and thirteen by the Isthmian Canal Commission from the performance of services by the commission, or from rentals, or from the sale of materials and supplies under the custody or control of the commission, are appropriated for expenditure under any of the foregoing classified appropriations for the department of construction and engineering, and a full and separate report in detail of all transactions under this section shall be made to Congress.

That until the close of the fiscal year nineteen hundred and thirteen, when any material, supplies, and equipment heretofore or hereafter purchased or acquired for the construction of the Isthmian Canal is no longer needed, or is no longer serviceable, it may be sold in such manner as the President may direct, and without advertising in such classes of cases as may be authorized by him; and the President is authorized, in his discretion, to sell and convey to the Republic of Panama the building situated in the city of Panama known as "the Administration Building," together with the ground on which the same is located, for a sum of not less than \$80,000, and the proceeds of such sale, if made, shall be covered into the Treasury of the United States.

SEC. 4. That hereafter no payments shall be made for maintenance or other charge in connection with the Toro Point Light, Isthmus of Panama, out of moneys of the United States or of the Panama Railroad Company.

SEC. 5. The chairman of the Isthmian Canal Commission is authorized to establish a division of records and, as the requirements of the service permit, to consolidate in the custody thereof the files of papers and other records which have accumulated or which may accumulate during the period of the construction of the Isthmian Canal; and he is directed to carefully preserve, properly index, and arrange for use all papers needed or useful in the transaction of current business or having a permanent value or historical interest; and he is authorized to destroy or otherwise dispose of duplications in the files and other papers which are not needed or useful in the transaction of current business and have no permanent value or historical interest and which have been recommended to him for destruction or other disposition by a committee of three competent persons who have personally examined the papers and in connection with their recommendation have submitted a concise statement of the condition and character thereof.

SEC. 6. Hereafter there shall be submitted, in the annual Book of Estimates, following every estimate for a general or lump sum appropriation which exceeds \$250,000 in amount, a statement showing in parallel columns:

First, the number of persons, if any, intended to be employed and the rates of compensation to each, and the amounts contemplated to be expended for each of any other objects or classes of expenditures specified or contemplated in the estimate; and

Second, the number of persons, if any, employed and the rates of compensation paid each, and the amounts expended for each other object or class of expenditures out of the appropriation corresponding to the estimate so submitted, during the completed fiscal year next preceding the period for which the estimate is submitted.

SEC. 7. No specific or indefinite appropriation made hereafter in any regular annual appropriation Act shall be construed to be permanent or available continuously without reference to a fiscal year unless it belongs to one of the following five classes: "Rivers and harbors," "lighthouses," "fortifications," "public buildings," and "pay of the Navy and Marine Corps," last specifically named in and excepted from the operation of the provisions of the so-called "covering-in Act" approved June twentieth, eighteen hundred and seventy-four, or unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the appropriation Act in which it is contained makes provision.

* * * * *

SEC. 10. That section eight of the District of Columbia Appropriation Act, approved June twenty-sixth, nineteen hundred and twelve, shall not take effect or be operative during the fiscal year nineteen hundred and thirteen except to the extent that it prohibits the payment of membership fees or dues in societies or associations: *Provided*, That during the fiscal year nineteen hundred and thirteen expenses of attendance of officers or employees of the Government at any meeting or convention of members of any society or association shall be incurred only on the written authority and direction of the heads of executive departments or other Government establishments or the Government of the District of Columbia; and a detailed statement of all such expenses incurred from June thirtieth until December first, nineteen hundred and twelve, shall be submitted to Congress on or before January first, nineteen hundred and thirteen.

SEC. 11. That all sums appropriated by this Act for salaries of officers and employees of the Government shall be in full for such salaries for the fiscal year nineteen hundred and thirteen, and all laws or parts of laws in conflict with the provisions of this Act are repealed.

Approved, August 24, 1912.

AN ACT To provide for the opening, maintenance, protection, and operation of the Panama Canal, and the sanitation and government of the Canal Zone.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the zone of land and land under water of the width of ten miles extending to the distance of five miles on each side of the center line of the route of the canal now being constructed thereon, which zone begins in the Caribbean Sea three marine miles from mean low-water mark and extends to and across the Isthmus of Panama into the Pacific Ocean to the distance of three marine miles from mean low-water mark, excluding therefrom the cities of Panama and Colon and their adjacent harbors located within said zone, as excepted in the treaty with the Republic of Panama dated November eighteenth, nineteen hundred and three, but including all islands within said described zone, and in addition thereto the group of islands in the Bay of Panama named Perico, Naos, Culebra, and Flamenco, and any lands and waters outside of said limits above described which are necessary or convenient or from time to time may become necessary or convenient for the construction, maintenance, operation, sanitation, or protection of the said canal or of any auxiliary canals, lakes, or other works necessary or convenient for the construction, maintenance, operation, sanitation, or protection of said canal, the use, occupancy, or control whereof were granted to the United States by the treaty between the United States and the Republic of Panama, the ratifications of which were exchanged on the twenty-sixth day of February, nineteen hundred and four, shall be known and designated as the Canal Zone, and the canal now being constructed thereon shall hereafter be known and designated as the Panama Canal. The President is authorized, by treaty with the Republic of Panama, to acquire any additional land or land under water not already granted, or which was excepted from the grant, that he may deem necessary for the operation, maintenance, sanitation, or protection of the Panama Canal, and to exchange any land or land under water not deemed necessary for such purposes for other land or land under water which may be deemed necessary for such purposes, which additional land or land under water so acquired shall become part of the Canal Zone.

SEC. 2. That all laws, orders, regulations, and ordinances adopted and promulgated in the Canal Zone by order of the President for the government and sanitation of the Canal Zone and the construction of the Panama Canal are hereby ratified and confirmed as valid and binding until Congress shall otherwise provide. The existing courts established in the Canal Zone by Executive order are recognized and confirmed to continue in operation until the courts provided for in this Act shall be established.

SEC. 3. That the President is authorized to declare by Executive order that all land and land under water within the limits of the Canal Zone is necessary for the construction, maintenance, operation, sanitation, or protection of the Panama Canal, and to extinguish, by agreement when advisable, all claims and titles of adverse claimants and occupants. Upon failure to secure by agreement title to any such parcel of land or land under water the adverse claim or occupancy shall be disposed of and title thereto secured in the United States and compensation therefor fixed and paid in the manner provided in the aforesaid treaty with the Republic of Panama, or such modification of such treaty as may hereafter be made.

SEC. 4. That when in the judgment of the President the construction of the Panama Canal shall be sufficiently advanced toward completion to render the further services of the Isthmian Canal Commission unnecessary the President is authorized by Executive order to discontinue the Isthmian Canal Commission, which, together with the present organization, shall then cease to exist; and the President is authorized thereafter to complete, govern, and operate the Panama Canal and govern the Canal Zone, or cause them to be completed, governed, and operated, through a governor of the Panama Canal and such other persons as he may deem competent to discharge the various duties connected with the completion, care, maintenance, sanitation, operation, government, and protection of the canal and Canal Zone. If any of the persons appointed or employed as aforesaid shall be persons in the military or naval service of the United States, the amount of the official salary paid to any such person shall be deducted from the amount of salary or compensation provided by or which shall be fixed under the terms of this Act. The governor of the Panama Canal shall be

appointed by the President, by and with the advice and consent of the Senate, commissioned for a term of four years, and until his successor shall be appointed and qualified. He shall receive a salary of ten thousand dollars a year. All other persons necessary for the completion, care, management, maintenance, sanitation, government, operation, and protection of the Panama Canal and Canal Zone shall be appointed by the President, or by his authority, removable at his pleasure, and the compensation of such persons shall be fixed by the President, or by his authority, until such time as Congress may by law regulate the same, but salaries or compensation fixed hereunder by the President shall in no instance exceed by more than twenty-five per centum the salary or compensation paid for the same or similar services to persons employed by the Government in continental United States. That upon the completion of the Panama Canal the President shall cause the same to be officially and formally opened for use and operation.

Before the completion of the canal, the Commission of Arts may make report to the President of their recommendation regarding the artistic character of the structures of the canal, such report to be transmitted to Congress.

SEC. 5. That the President is hereby authorized to prescribe and from time to time change the tolls that shall be levied by the Government of the United States for the use of the Panama Canal: *Provided*, That no tolls, when prescribed as above, shall be changed, unless six months' notice thereof shall have been given by the President by proclamation. No tolls shall be levied upon vessels engaged in the coastwise trade of the United States. That section forty-one hundred and thirty-two of the Revised Statutes is hereby amended to read as follows:

"SEC. 4132. Vessels built within the United States and belonging wholly to citizens thereof; and vessels which may be captured in war by citizens of the United States and lawfully condemned as prize, or which may be adjudged to be forfeited for a breach of the laws of the United States; and seagoing vessels, whether steam or sail, which have been certified by the Steamboat-Inspection Service as safe to carry dry and perishable cargo, not more than five years old at the time they apply for registry, wherever built, which are to engage only in trade with foreign countries or with the Philippine Islands and the islands of Guam and Tutuila, being wholly owned by citizens of the United States or corporations organized and chartered under the laws of the United States or of any State thereof, the president and managing directors of which shall be citizens of the United States or corporations organized and chartered under the laws of the United States or of any State thereof, the president and managing directors of which shall be citizens of the United States, and no others, may be registered as directed in this title. Foreign-built vessels registered pursuant to this Act shall not engage in the coastwise trade: *Provided*, That a foreign-built yacht, pleasure boat, or vessel not used or intended to be used for trade admitted to American registry pursuant to this section shall not be exempt from the collection of ad valorem duty provided in section thirty-seven of the Act approved August fifth, nineteen hundred and nine, entitled 'An Act to provide revenue, equalize duties, and encourage the industries of the United States, and for other purposes.' That all materials of foreign production which may be necessary for the construction or repair of vessels built in the United States and all such materials necessary for the building or repair of their machinery and all articles necessary for their outfit and equipment may be imported into the United States free of duty under such regulations as the Secretary of the Treasury may prescribe: *Provided further*, That such vessels so admitted under the provisions of this section may contract with the Postmaster General under the Act of March third, eighteen hundred and ninety-one, entitled 'An Act to provide for ocean mail service between the United States and foreign ports, and to promote commerce,' so long as such vessels shall in all respects comply with the provisions and requirements of said Act."

Tolls may be based upon gross or net registered tonnage, displacement tonnage, or otherwise, and may be based on one form of tonnage for warships and another for ships of commerce. The rate of tolls may be lower upon vessels in ballast than upon vessels carrying passengers or cargo. When based upon net registered tonnage for ships of commerce the tolls shall not exceed one dollar and twenty-five cents per net registered ton, nor be less, other than for vessels of the United States and its citizens, than the estimated proportionate cost of the actual maintenance and operation of the canal subject, however, to the provisions of article nineteen of the convention between the United States and the Republic of Panama, entered into November eighteenth, nineteen hundred and three. If the tolls shall not be based upon net registered tonnage, they shall not exceed the equivalent of one dollar and twenty-five cents per net registered ton as nearly as the same may be determined, nor be less than the equivalent of seventy-five cents per net registered ton. The toll for each passenger shall not be more than one dollar and fifty cents. The President is authorized to make and from time to time amend regulations governing the operation of

the Panama Canal, and the passage and control of vessels through the same or any part thereof, including the locks and approaches thereto, and all rules and regulations affecting pilots and pilotage in the canal or the approaches thereto through the adjacent waters.

Such regulations shall provide for prompt adjustment by agreement and immediate payment of claims for damages which may arise from injury to vessels, cargo, or passengers from the passing of vessels through the locks under the control of those operating them under such rules and regulations. In case of disagreement suit may be brought in the district court of the Canal Zone against the governor of the Panama Canal. The hearing and disposition of such cases shall be expedited and the judgment shall be immediately paid out of any moneys appropriated or allotted for canal operation.

The President shall provide a method for the determination and adjustment of all claims arising out of personal injuries to employees thereafter occurring while directly engaged in actual work in connection with the construction, maintenance, operation, or sanitation of the canal or of the Panama Railroad, or of any auxiliary canals, locks, or other works necessary and convenient for the construction, maintenance, operation, or sanitation of the canal, whether such injuries result in death or not, and prescribe a schedule of compensation therefor, and may revise and modify such method and schedule at any time; and such claims, to the extent they shall be allowed on such adjustment, if allowed at all, shall be paid out of the moneys hereafter appropriated for that purpose or out of the funds of the Panama Railroad Company, if said company was responsible for said injury, as the case may require. And after such method and schedule shall be provided by the President, the provisions of the Act entitled "An Act granting to certain employees of the United States the right to receive from it compensation for injuries sustained in the course of their employment," approved May thirtieth, nineteen hundred and eight, and of the Act entitled "An Act relating to injured employees on the Isthmian Canal," approved February twenty-fourth, nineteen hundred and nine, shall not apply to personal injuries thereafter received and claims for which are subject to determination and adjustment as provided in this section.

SEC. 6. That the President is authorized to cause to be erected, maintained, and operated, subject to the International Convention and the Act of Congress to regulate radio-communication, at suitable places along the Panama Canal and the coast adjacent to its two terminals, in connection with the operation of said canal, such wireless telegraphic installations as he may deem necessary for the operation, maintenance, sanitation, and protection of said canal, and for other purposes. If it is found necessary to locate such installations upon territory of the Republic of Panama, the President is authorized to make such agreement with said Government as may be necessary, and also to provide for the acceptance and transmission, by said system, of all private and commercial messages, and those of the Government of Panama, on such terms and for such tolls as the President may prescribe: *Provided*, That the messages of the Government of the United States and the departments thereof, and the management of the Panama Canal, shall always be given precedence over all other messages. The President is also authorized, in his discretion, to enter into such operating agreements or leases with any private wireless company or companies as may best insure freedom from interference with the wireless telegraphic installations established by the United States. The President is also authorized to establish, maintain, and operate, through the Panama Railroad Company or otherwise, dry docks, repair shops, yards, docks, wharves, warehouses, storehouses, and other necessary facilities and appurtenances for the purpose of providing coal and other materials, labor, repairs, and supplies for vessels of the Government of the United States and, incidentally, for supplying such at reasonable prices to passing vessels, in accordance with appropriations hereby authorized to be made from time to time by Congress as a part of the maintenance and operation of the said canal. Moneys received from the conduct of said business may be expended and reinvested for such purposes without being covered into the Treasury of the United States; and such moneys are hereby appropriated for such purposes, but all deposits of such funds shall be subject to the provisions of existing law relating to the deposit of other public funds of the United States, and any net profits accruing from such business shall annually be covered into the Treasury of the United States. Monthly reports of such receipts and expenditures shall be made to the President by the persons in charge, and annual reports shall be made to the Congress.

SEC. 7. That the governor of the Panama Canal shall, in connection with the operation of such canal, have official control and jurisdiction over the Canal Zone and shall perform all duties in connection with the civil government of the Canal Zone, which is to be held, treated, and governed as an adjunct of such Panama Canal. Unless in this

Act otherwise provided all existing laws of the Canal Zone referring to the civil governor or the civil administration of the Canal Zone shall be applicable to the governor of the Panama Canal, who shall perform all such executive and administrative duties required by existing law. The President is authorized to determine or cause to be determined what towns shall exist in the Canal Zone and subdivide and from time to time resubdivide said Canal Zone into subdivisions, to be designated by name or number, so that there shall be situated one town in each subdivision, and the boundaries of each subdivision shall be clearly defined. In each town there shall be a magistrate's court with exclusive original jurisdiction coextensive with the subdivision in which it is situated of all civil cases in which the principal sum claimed does not exceed three hundred dollars, and all criminal cases wherein the punishment that may be imposed shall not exceed a fine of one hundred dollars, or imprisonment not exceeding thirty days, or both, and all violations of police regulations and ordinances and all actions involving possession or title to personal property or the forcible entry and detainer of real estate. Such magistrates shall also hold preliminary investigations in charges of felony and offenses under section ten of this Act, and commit or bail in bailable cases to the district court. A sufficient number of magistrates and constables, who must be citizens of the United States, to conduct the business of such courts, shall be appointed by the governor of the Panama Canal for terms of four years and until their successors are appointed and qualified, and the compensation of such persons shall be fixed by the President, or by his authority, until such time as Congress may by law regulate the same. The rules governing said courts and prescribing the duties of said magistrates and constables, oaths and bonds, the times and places of holding such courts, the disposition of fines, costs, forfeitures, enforcements of judgments, providing for appeals therefrom to the district court, and the disposition, treatment, and pardon of convicts shall be established by order of the President. The governor of the Panama Canal shall appoint all notaries public, prescribe their powers and duties, their official seal, and the fees to be charged and collected by them.

SEC. 8. That there shall be in the Canal Zone one district court with two divisions, one including Balboa and the other including Cristobal; and one district judge of the said district, who shall hold his court in both divisions at such time as he may designate by order, at least once a month in each division. The rules of practice in such district court shall be prescribed or amended by order of the President. The said district court shall have original jurisdiction of all felony cases, of offenses arising under section ten of this Act, all causes in equity; admiralty and all cases at law involving principal sums exceeding three hundred dollars and all appeals from judgments rendered in magistrates' courts. The jurisdiction in admiralty herein conferred upon the district judge and the district court shall be the same that is exercised by the United States district judges and the United States district courts, and the procedure and practice shall also be the same. The district court or the judge thereof shall also have jurisdiction of all other matters and proceedings not herein provided for which are now within the jurisdiction of the Supreme Court of the Canal Zone, of the Circuit Court of the Canal Zone, the District Court of the Canal Zone, or the judges thereof. Said judge shall provide for the selection, summoning, serving, and compensation of jurors from among the citizens of the United States, to be subject to jury duty in either division of such district, and a jury shall be had in any criminal case or civil case at law originating in said court on the demand of either party. There shall be a district attorney and a marshal for said district. It shall be the duty of the district attorney to conduct all business, civil and criminal, for the Government, and to advise the governor of the Panama Canal on all legal questions touching the operation of the canal and the administration of civil affairs. It shall be the duty of the marshal to execute all process of the court, preserve order therein, and do all things incident to the office of marshal. The district judge, the district attorney, and the marshal shall be appointed by the President, by and with the advice and consent of the Senate, for terms of four years each, and until their successors are appointed and qualified, and during their terms of office shall reside within the Canal Zone, and shall hold no other office nor serve on any official board or commission nor receive any emoluments except their salaries. The district judge shall receive the same salary paid the district judges of the United States, and shall appoint the clerk of said court, and may appoint one assistant when necessary, who shall receive salaries to be fixed by the President. The district judge shall be entitled to six weeks' leave of absence each year with pay. During his absence or during any period of disability or disqualification from sickness or otherwise to discharge his duties the same shall be temporarily performed by any circuit or district judge of the United States who may be designated by the President, and who, during such service, shall receive the additional mileage and per diem allowed by law to district judges of the United States when holding court away from their homes. The district attorney and the marshal shall be paid each a salary of five thousand dollars per annum.

SEC. 9. That the records of the existing courts and all causes, proceedings, and criminal prosecutions pending therein as shown by the dockets thereof, except as herein otherwise provided, shall immediately upon the organization of the courts created by this Act be transferred to such new courts having jurisdiction of like cases, be entered upon the dockets thereof, and proceed as if they had originally been brought therein, whereupon all the existing courts, except the supreme court of the Canal Zone, shall cease to exist. The President may continue the supreme court of the Canal Zone and retain the judges thereof in office for such time as to him may seem necessary to determine finally any causes and proceedings which may be pending therein. All laws of the Canal Zone imposing duties upon the clerks or ministerial officers of existing courts shall apply and impose such duties upon the clerks and ministerial officers of the new courts created by this Act having jurisdiction of like cases, matters, and duties.

All existing laws in the Canal Zone governing practice and procedure in existing courts shall be applicable and adapted to the practice and procedure in the new courts.

The Circuit Court of Appeals of the Fifth Circuit of the United States shall have jurisdiction to review, revise, modify, reverse, or affirm the final judgments and decrees of the District Court of the Canal Zone and to render such judgments as in the opinion of the said appellate court should have been rendered by the trial court in all actions and proceedings in which the Constitution, or any statute, treaty, title, right, or privilege of the United States, is involved and a right thereunder denied, and in cases in which the value in controversy exceeds one thousand dollars, to be ascertained by the oath of either party, or by other competent evidence, and also in criminal causes wherein the offense charged is punishable as a felony. And such appellate jurisdiction, subject to the right of review by or appeal to the Supreme Court of the United States as in other cases authorized by law, may be exercised by said circuit court of appeals in the same manner, under the same regulations, and by the same procedure as nearly as practicable as is done in reviewing the final judgments and decrees of the district courts of the United States.

SEC. 10. That after the Panama Canal shall have been completed and opened for operation the governor of the Panama Canal shall have the right to make such rules and regulations, subject to the approval of the President, touching the right of any person to remain upon or pass over any part of the Canal Zone as may be necessary. Any person violating any of such rules or regulations shall be guilty of a misdemeanor, and on conviction in the District Court of the Canal Zone shall be punished by a fine not exceeding five hundred dollars or by imprisonment not exceeding a year, or both, in the discretion of the court. It shall be unlawful for any person, by any means or in any way, to injure or obstruct, or attempt to injure or obstruct, any part of the Panama Canal or the locks thereof or the approaches thereto. Any person violating this provision shall be guilty of a felony, and on conviction in the District Court of the Canal Zone shall be punished by a fine not exceeding ten thousand dollars or by imprisonment not exceeding twenty years, or both, in the discretion of the court. If the act shall cause the death of any person within a year and a day thereafter, the person so convicted shall be guilty of murder and shall be punished accordingly.

SEC. 11. That section five of the Act to regulate commerce, approved February fourth, eighteen hundred and eighty-seven, as heretofore amended, is hereby amended by adding thereto a new paragraph at the end thereof, as follows:

"From and after the first day of July, nineteen hundred and fourteen, it shall be unlawful for any railroad company or other common carrier subject to the act to regulate commerce to own, lease, operate, control, or have any interest whatsoever (by stock ownership or otherwise, either directly, indirectly, through any holding company, or by stockholders or directors in common, or in any other manner) in any common carrier by water operated through the Panama Canal or elsewhere with which said railroad or other carrier aforesaid does or may compete for traffic or any vessel carrying freight or passengers upon said water route or elsewhere with which said railroad or other carrier aforesaid does or may compete for traffic; and in case of the violation of this provision each day in which such violation continues shall be deemed a separate offense."

Jurisdiction is hereby conferred on the Interstate Commerce Commission to determine questions of fact as to the competition or possibility of competition, after full hearing, on the application of any railroad company or other carrier. Such application may be filed for the purpose of determining whether any existing service is in violation of this section and pray for an order permitting the continuance of any vessel or vessels already in operation, or for the purpose of asking an order to install new service not in conflict with the provisions of this paragraph. The commission may on its own motion or the application of any shipper institute proceedings to inquire

into the operation of any vessel in use by any railroad or other carrier which has not applied to the commission and had the question of competition or the possibility of competition determined as herein provided. In all such cases the order of said commission shall be final.

If the Interstate Commerce Commission shall be of the opinion that any such existing specified service by water other than through the Panama Canal is being operated in the interest of the public and is of advantage to the convenience and commerce of the people, and that such extension will neither exclude, prevent, nor reduce competition on the route by water under consideration, the Interstate Commerce Commission may, by order, extend the time during which such service by water may continue to be operated beyond July first, nineteen hundred and fourteen. In every case of such extension the rates, schedules, and practices of such water carrier shall be filed with the Interstate Commerce Commission and shall be subject to the act to regulate commerce and all amendments thereto in the same manner and to the same extent as is the railroad or other common carrier controlling such water carrier or interested in any manner in its operation: *Provided*, Any application for extension under the terms of this provision filed with the Interstate Commerce Commission prior to July first, nineteen hundred and fourteen, but for any reason not heard and disposed of before said date, may be considered and granted thereafter.

No vessel permitted to engage in the coastwise or foreign trade of the United States shall be permitted to enter or pass through said canal if such ship is owned, chartered, operated, or controlled by any person or company which is doing business in violation of the provisions of the Act of Congress approved July second, eighteen hundred and ninety, entitled "An Act to protect trade and commerce against unlawful restraints and monopolies," or the provisions of sections seventy-three to seventy-seven, both inclusive, of an Act approved August twenty-seventh, eighteen hundred and ninety-four, entitled "An Act to reduce taxation, to provide revenue for the Government, and for other purposes," or the provisions of any other Act of Congress amending or supplementing the said Act of July second, eighteen hundred and ninety, commonly known as the Sherman Antitrust Act, and amendments thereto, or said sections of the Act of August twenty-seventh, eighteen hundred and ninety-four. The question of fact may be determined by the judgment of any court of the United States of competent jurisdiction in any cause pending before it to which the owners or operators of such ship are parties. Suit may be brought by any shipper or by the Attorney General of the United States.

That section six of said Act to regulate commerce, as heretofore amended, is hereby amended by adding a new paragraph at the end thereof, as follows:

"When property may be or is transported from point to point in the United States by rail and water through the Panama Canal or otherwise, the transportation being by a common carrier or carriers, and not entirely within the limits of a single State, the Interstate Commerce Commission shall have jurisdiction of such transportation and of the carriers, both by rail and by water, which may or do engage in the same, in the following particulars, in addition to the jurisdiction given by the Act to regulate commerce, as amended June eighteenth, nineteen hundred and ten:

"(a) To establish physical connection between the lines of the rail carrier and the dock of the water carrier by directing the rail carrier to make suitable connection between its line and a track or tracks which have been constructed from the dock to the limits of its right of way, or by directing either or both the rail and water carrier, individually or in connection with one another, to construct and connect with the lines of the rail carrier a spur track or tracks to the dock. This provision shall only apply where such connection is reasonably practicable, can be made with safety to the public, and where the amount of business to be handled is sufficient to justify the outlay.

"The commission shall have full authority to determine the terms and conditions upon which these connecting tracks, when constructed, shall be operated, and it may, either in the construction or the operation of such tracks, determine what sum shall be paid to or by either carrier. The provisions of this paragraph shall extend to cases where the dock is owned by other parties than the carrier involved.

"(b) To establish through routes and maximum joint rates between and over such rail and water lines, and to determine all the terms and conditions under which such lines shall be operated in the handling of the traffic embraced.

"(c) To establish maximum proportional rates by rail to and from the ports to which the traffic is brought, or from which it is taken by the water carrier, and to determine to what traffic and in connection with what vessels and upon what terms and conditions such rates shall apply. By proportional rates are meant those which differ from the corresponding local rates to and from the port and which apply only to traffic which has been brought to the port or is carried from the port by a common carrier by water.

"(d) If any rail carrier subject to the Act to regulate commerce enters into arrangements with any water carrier operating from a port in the United States to a foreign country, through the Panama Canal or otherwise, for the handling of through business between interior points of the United States and such foreign country, the Interstate Commerce Commission may require such railway to enter into similar arrangements with any or all other lines of steamships operating from said port to the same foreign country."

The orders of the Interstate Commerce Commission relating to this section shall only be made upon formal complaint or in proceedings instituted by the commission of its own motion and after full hearing. The orders provided for in the two amendments to the Act to regulate commerce enacted in this section shall be served in the same manner and enforced by the same penalties and proceedings as are the orders of the commission made under the provisions of section fifteen of the Act to regulate commerce, as amended June eighteenth, nineteen hundred and ten, and they may be conditioned for the payment of any sum or the giving of security for the payment of any sum or the discharge of any obligation which may be required by the terms of said order.

SEC. 12. That all laws and treaties relating to the extradition of persons accused of crime in force in the United States, to the extent that they may not be in conflict with or superseded by any special treaty entered into between the United States and the Republic of Panama with respect to the Canal Zone, and all laws relating to the rendition of fugitives from justice as between the several States and Territories of the United States, shall extend to and be considered in force in the Canal Zone, and for such purposes and such purposes only the Canal Zone shall be considered and treated as an organized Territory of the United States.

SEC. 13. That in time of war in which the United States shall be engaged, or when, in the opinion of the President, war is imminent, such officer of the Army as the President may designate shall, upon the order of the President, assume and have exclusive authority and jurisdiction over the operation of the Panama Canal and all of its adjuncts, appendants, and appurtenances, including the entire control and government of the Canal Zone, and during a continuance of such condition the governor of the Panama Canal shall, in all respects and particulars as to the operation of such Panama Canal, and all duties, matters, and transactions affecting the Canal Zone, be subject to the order and direction of such officer of the Army.

SEC. 14. That this Act shall be known as, and referred to as, the Panama Canal Act, and the right to alter, amend, or repeal any or all of its provisions or to extend, modify, or annul any rule or regulation made under its authority is expressly reserved.

Approved, August 24, 1912.

EXECUTIVE ORDER.

Providing for the Inspection of Steam Vessels.

By virtue of the authority vested in me, I hereby establish the following Order in the Canal Zone:

SECTION 1. Every vessel propelled in whole or in part by machinery shall be deemed a steam vessel within the meaning of this Order.

SEC. 2. All steam vessels navigating the waters of the Canal Zone, except public vessels of the United States or other countries, shall be subject to the provisions of this Order.

SEC. 3. The Board of Local Inspectors of the Canal Zone shall cause the hull of each steam vessel navigating the waters of the Canal Zone to be carefully inspected at least once every year, and shall satisfy themselves that every such vessel so inspected is of a structure suitable for the service in which she is to be employed, and has suitable accommodations for passengers and crew, and is in a condition to warrant the belief that she may be used in navigation with safety to life, and that all the requirements of the law in regard to fire, boats, pumps, hose, life-preservers, floats, signals, and other things are faithfully complied with, and if they deem it expedient they may cause the vessel to be put in motion and may adopt any other suitable means to test her efficiency and that of her equipment.

SEC. 4. Whenever the Board of Local Inspectors shall find on board any vessel subject to the provisions of this Order any equipment, machinery, apparatus or appliance which does not conform to the requirements of the law, the Board shall require the same to be placed in proper condition by the owner or master of the vessel, and if the said Board shall find in any such vessel any life-preserver or fire-hose so defective

as to be incapable of repair, the Board shall require the same to be destroyed in the presence of some person appointed by the Board to represent it.

SEC. 5. The Board of Local Inspectors shall cause the boilers and all appurtenances of all steam vessels to be carefully inspected before the same shall be used, and at least once every year thereafter, and shall subject all boilers to the hydrostatic test in the ratio of 150 pounds to the square inch to 100 pounds to the square inch of the working steam power allowed. All such vessels shall comply with the following requirements, viz.:

That the boilers are well made, of good and suitable material, design suitable for the service in which employed, and to be equipt with the proper safety appliances, and of such construction, shape, condition, arrangement and material that they may be safely employed in the service proposed without peril to life; and the Board of Local Inspectors shall cause an examination to be made to satisfy itself that the requirements of these regulations have been complied with.

SEC. 6. When the inspection of a steam vessel is completed and the Board of Local Inspectors approve the vessel and her equipment, the Chairman of the Board shall make and subscribe a certificate to the Collector of Revenues in accordance with the form to be prescribed by the Board. Every certificate granted to steamers carrying passengers shall state the number of passengers of each class that any such steamer has accommodations for and can carry with prudence and safety.

If the Board of Local Inspectors refuse to grant a certificate of approval, the Chairman thereof shall make a statement in writing and give his reasons for such disapproval, and shall sign the statement as such Chairman and file the same in the records of the Board, giving a copy thereof to the owner or master of the vessel.

SEC. 7. All foreign private steam vessels carrying passengers to or from any port or place within the limits of the Canal Zone shall be subject to the provisions of this Order, *Provided*, That if any foreign passenger steamer of a country which has inspection laws approximating those of the United States has an unexpired certificate of inspection duly issued by the authorities of the country to which the vessel belongs, the said vessel shall not be subjected to an inspection other than that necessary to satisfy the Board of Local Inspectors that the condition of the vessel, her boilers and life-saving equipment are as stated in her certificate of inspection; but no such certificate of inspection shall be accepted as evidence of lawful inspection unless like privileges are granted to steam vessels of the United States under the laws of the country to which such vessel belongs.

SEC. 8. Private steam vessels duly registered in the United States having unexpired certificates of inspection issued by the proper authorities in the United States shall not be subject to inspection hereunder.

SEC. 9. The Collector of Revenues shall retain on file all original certificates of inspection required to be delivered to him by the Board of Local Inspectors, and shall give to the master or owner of the vessel therein named three certified copies thereof, two of which shall be placed by such master or owner in conspicuous places in the vessel where they will be most likely to be observed by the passengers and others, and there kept at all times framed under glass; and the other shall be retained by such master or owner as evidence of the authority thereby conferred.

SEC. 10. Before issuing an inspection certificate to any vessel, the Collector of Revenues shall demand and receive from the owner or master of such vessel as compensation for inspection and examination made for the year, the following sums, in addition to the fees for issuing enrollments and licenses now allowed by law:

For each steam vessel of 100 tons or under	\$10.00
For each and every ton in excess of 100 tons	5c.

The fees herein provided for shall cover the cost of the certificate, as well as the inspection and examination of the vessel, which fees shall be for the use and benefit of the Canal Zone Treasury.

SEC. 11. Whenever any passenger is received on board of any steam vessel not having the certified copies of the certificate of approval placed and kept as required by this Order, such vessel shall be liable to a fine of one hundred dollars for each passenger so received, to be recovered in the Circuit Court of the circuit in which the vessel is to be found, and the money so recovered shall be a lien upon the vessel, which may be seized and sold to satisfy the same, as well as all costs of the proceeding.

SEC. 12. No steamer carrying passengers shall depart from any port or place in the Canal Zone unless it shall have in its service a full complement of licensed officers and a full crew, as in the judgment of the Board of Local Inspectors may be sufficient at all times to manage the vessel.

SEC. 13. Every steam vessel licensed under the provisions of this Order shall have on board in an accessible place one life-preserver for every person allowed to be

carried, in addition to those provided for the crew of such vessel; and if a greater number of passengers than is stated in the certificate is taken on board of any vessel within the waters of the Canal Zone, the master or owner of such vessel shall be liable to any person suing for the same to refund the passage money and ten dollars for each passenger beyond the number allowed.

SEC. 14. If any passenger steamer engages in excursions within or from the waters of the Canal Zone, the Board of Local Inspectors shall issue to such steamer a special permit in writing for the occasion, in which shall be stated the additional number of passengers that may be carried and the number and kind of life-saving appliances that may be provided for the safety of such additional passengers, and they shall also, in their discretion, limit the route and distance for such excursions.

SEC. 15. The master of every passenger steamer shall keep a correct list of all passengers received on board the vessel, which record shall be open to the inspection of the Inspectors and the officers of the customs at all times, and the correct number of passengers shall be furnished to the Inspectors as often as called for.

SEC. 16. Every master of a passenger steamer who fails through negligence or design to keep a list of passengers as required by the preceding section shall be liable to a fine of one hundred dollars, to be recovered in the Circuit Court of the circuit in which the vessel is to be found.

SEC. 17. Every steam vessel carrying passengers shall be provided with two good double-acting fire pumps to be worked by hand; each chamber of such pumps shall be of sufficient capacity to contain not less than one hundred cubic inches of water and such pumps shall be placed in the most suitable part of such vessel for efficient service, having suitable well-fitted hose to each pump at least one half the vessel in length and kept at all times in perfect order and shipped up and ready for use. On every steamer not exceeding two hundred tons, one such pump may be dispensed with. Each fire pump shall be supplied with water by a suitable pipe connection passing through the side of the vessel so low as to be under water at all times, and no fire pump thus provided shall be placed below the lower deck of the vessel. Every steamer shall also be provided with a pump which shall be of sufficient strength and suitably arranged to test the boilers thereof.

SEC. 18. Every vessel coming within the provisions of this Order shall be provided with such number of lifeboats, floats, rafts, life-preservers, line carrying projectiles and best means of propelling them, and drags, as in the judgment of the Board of Local Inspectors will best procure the safety of all persons on-board such vessels in case of disaster. And every such vessel shall have the lifeboats required by this Order provided with suitable boat disengaging apparatus, so arranged as to allow such boats to be safely launched while such vessels are under speed or otherwise so as to allow such disengaging apparatus to be operated by one person, disengaging both ends of the boat simultaneously from the tackle by which it may be lowered to the water; and the Board of Local Inspectors shall determine the kind of lifeboats, floats, rafts, life-preservers, line-carrying projectiles and means of propelling the same, and drags which are to be used on the vessel, and also the kind and capacity of the pumps for freeing the vessel from water in case of heavy leakage, the capacity of such pumps being suited to the navigation in which the vessel is employed.

SEC. 19. The owner or master of any such vessel who refuses to provide such lifeboats, floats, rafts, life-preservers, line carrying projectiles and means of propelling them, drags, pumps or appliances which, under the provisions of the preceding sections are required by the Board of Local Inspectors, shall be fined one thousand dollars, and the same may be enforced against the owner of the vessel personally or as a lien upon the vessel, which may be seized and sold to satisfy such fine and costs of court.

SEC. 20. The Board of Local Inspectors shall have the power to enforce the requirements of this Order—first, by not granting a certificate—second, by revoking the certificate already issued to the vessel.

The owner or master of the vessel may appeal from the action of the Board of Local Inspectors to the Head of the Department of Civil Administration at any time within ten days after the final action of the Board; and the Head of the Department of Civil Administration may modify or set aside the action of the Local Board, and he shall certify his ruling to the Board for observance in each case.

SEC. 21. Whenever a steamer engaged in carrying passengers to or from the Canal Zone enters the waters of the Canal Zone, it shall be the duty of the Captain of the Port to notify the master or agent of such vessel that the same is subject to the inspection laws of the Canal Zone; and after being so notified, it shall be the duty of the said agent or master to make a written request to the Board of Local Inspectors for the inspection of the vessel and her equipment in accordance with the provisions of this

Order. Any agent or master of a vessel who fails or refuses to make the written request as herein provided for after receiving the notice above-mentioned from the Captain of the Port, shall be liable to a fine of fifty dollars upon his conviction in the Circuit Court of the Circuit in which said agent or master is to be found.

SEC. 22. Any violation of any of the provisions of this Order, for which a specific punishment is not prescribed herein, shall subject the owner or master of the offending vessel to a fine not exceeding one thousand dollars, or by imprisonment in jail not exceeding six months, or both such fine and imprisonment in the discretion of the Court.

SEC. 23. The fines and penalties imposed under this Order shall constitute a lien on the vessel in each case, and upon judgment for any such fine or penalty execution may issue therefor, as in civil cases, against such vessel, and same shall be sold to satisfy such execution; and the Court may order the provisional detention of such vessel to abide the judgment of the Court; but a bond, to be approved by the Judge of the Court, may be given to secure the payment of any judgment that may be rendered, and the vessel shall be released thereon.

SEC. 24. The Canal Commission may establish rules and regulations not inconsistent herewith for the better enforcement of this Order.

SEC. 25. This Order shall take effect ninety days after the same shall have been published in The Canal Record.¹

WM. H. TAFT.

THE WHITE HOUSE, July 21, 1911.

EXECUTIVE ORDER.

Against the Promotion of Fights between Bulls, Dogs, or Cocks.

By virtue of the authority vested in me, I hereby establish the following order for the Canal Zone.

SECTION 1. Any person who sets on foot, instigates, promotes or carries on any fights between cocks or other birds, or any dog fight, or bull fight, or fight between other animals; or who does any act as assistant, umpire or principal in furtherance of any fight between any such animals, shall be punished by a fine not to exceed fifty dollars, or by imprisonment not to exceed thirty days, or by both such fine and imprisonment, in the discretion of the court.

SEC. 2. This order shall take effect thirty days from this date.

WM. H. TAFT.

THE WHITE HOUSE, August 4, 1911.

EXECUTIVE ORDER.

To prohibit the placing of signs on lands and property of the United States and the Panama Railroad Company.

By virtue of the authority vested in me, I hereby establish the following Executive Order for the Canal Zone.

SECTION 1. It shall be unlawful for any person to construct or place any sign, bill, poster or other advertising device on any land, building or other structure owned or controlled by the United States or the Panama Railroad Company in the Canal Zone; and any person thus offending shall be punished by a fine of not less than five dollars nor more than twenty-five dollars, or by imprisonment in jail not to exceed thirty days, or by both such fine and imprisonment in the discretion of the court; and every day that such sign, bill, poster or other advertising device shall remain upon such lands or structures shall be deemed a separate offense. *Provided*, however, that this Order shall not be construed to prevent persons from advertising, by means of any such advertising devices the business that they may be conducting according to law in any building or other structure upon which such advertising device is constructed or placed.

SEC. 2. This Order shall take effect sixty days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, September 8, 1911.

¹ Published in The Canal Record of August 16, 1911.

EXECUTIVE ORDER.

Establishing the Postal Savings System in the Canal Zone.

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

SECTION 1.—There is hereby established in the post offices of the Canal Zone a postal savings system, to be operated without the payment of interest on the deposits under such rules and regulations as may be now or hereafter adopted.

SEC. 2. There is hereby created a Board of Trustees for the control, supervision and administration of the postal savings depository offices designated and established under the provisions of this Order, and of the funds received as deposits at such postal savings depository offices by virtue thereof. Said Board shall consist of the Collector of Revenues of the Canal Zone, the Auditor of the Canal Zone Government, and the Treasurer of the Canal Zone, severally, acting ex-officio, and shall have power to make all necessary and proper regulations for the receipt, transmittal, custody, deposit, investment and repayment of the funds deposited at postal savings depository offices; the regulations above-mentioned to be subject to the approval of the Chairman of the Isthmian Canal Commission.

SEC. 3. Said Board of Trustees is hereby authorized and empowered to designate such post offices as it may select to be postal savings depository offices, and each and every post office so designated by order of said Board is hereby declared to be a postal savings depository office within the meaning of this Order and to be authorized and required to receive deposits of funds from the public and to account for and dispose of the same, according to the provisions of this Order and the regulations made in pursuance thereof. Each postal savings depository office shall be kept open for the transaction of business during such hours as the Collector of Revenues shall direct.

SEC. 4. That accounts may be opened and deposits made in any postal savings depository established under this Order by any person of the age of ten years or over, in his or her own name, and by a married woman in her own name and free from any control or interference by her husband; but no person shall at the same time have more than one postal savings account in his or her own right.

SEC. 5. At least one dollar, or a larger amount in multiples thereof, must be deposited before an account is opened with a person depositing the same; and one dollar, or multiples thereof, may be deposited after such account has been opened. Postal savings deposits will be evidenced by postal savings certificates issued in fixed denominations of \$1, \$2, \$5, \$10, \$20, \$50, \$100, each bearing the name of the depositor, the number of his account, the date of issue, and the name of the depository office.

SEC. 6. Any depositor may withdraw the whole or any part of the funds deposited to his or her credit upon demand, and under such regulations as the Board of Trustees may prescribe.

SEC. 7. Postal savings funds received under the provisions of this Order shall be deposited with the Treasurer of the Canal Zone under such regulations as the Board of Trustees may prescribe.

SEC. 8. Postal savings depository funds shall be kept separate from other funds by postmasters and other officers and employees of the postal service, who shall be held to the same accountability under their bonds for such funds as for public moneys; and no person connected with the Post Office Department shall disclose to any person other than the depositor the amount of any deposits, unless directed so to do by the Collector of Revenues.

SEC. 9. That the final judgment, order or decree of any court of competent jurisdiction adjudicating any right or interest in the credit of any sum deposited by any person with the postal savings depository, if the same shall not have been appealed from and the time for appeal have expired, upon submission to the Collector of Revenues of a copy of the same, duly authenticated in the manner provided by the laws of the United States for the authentication of the records and judicial proceedings of the courts of any state or territory, or of any possession subject to the jurisdiction of the United States, when the same are proved or admitted within any other court within the United States, shall be accepted by the Board of Trustees as conclusive of the title, right, interest or possession so adjudicated; and any payment of said sum in accordance with such order, judgment or decree shall operate as a full and complete discharge of the United States and the Canal Zone Government from the claim or demand of any person or persons to the same.

SEC. 10. This Order shall take effect and be in force sixty days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, September 8, 1911.

EXECUTIVE ORDER.

To amend Sections 51, 62, and 526, and to repeal Sections 63 and 529 of the Code of Civil Procedure of the Canal Zone.

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

ARTICLE I. Section 51 of the Code of Civil Procedure of the Canal Zone is hereby amended to read as follows:

SEC. 51. Pleadings in the District Courts shall be oral, except when they are required by law to be verified by the oath of either of the parties to the suit, in which case the pleadings shall be in writing.

ART. II. Section 62 of the above mentioned Code is hereby amended so as to read as follows:

SEC. 62. Every District Judge shall keep a well bound book styled "Docket," in which he shall enter the name and style of every civil suit brought before him; the dates of issuing process therein and of the return thereof; a brief statement of the nature of the suit and of any plea made thereto by the defendant, and if no appearance is made, the defendant's default shall be noted; the names of the witnesses sworn; the date and the amount of the judgment; the date of issuing execution or other process upon the judgment, and a copy of the returns thereon; the appeal, when and by whom demanded; and briefly all the proceedings before him touching the suit.

Each District Judge, at the beginning of his docket and before any entries are made therein shall make and subscribe the following certificate, substantially, to wit:

"A docket of proceedings in civil matters before.....
District Judge of the Administrative District of.....,
Canal Zone.

Witness my signature.

.....
District Judge."

ART. III. Section 526 of the above mentioned code is hereby amended so as to read as follows:

SEC. 526. Costs shall ordinarily be allowed to the prevailing party as a matter of course, but the court shall have power for special reasons to adjudge that either party shall pay the costs of an action, or that the same be divided as may be equitable; and the court may, for sufficient cause, order that no costs be taxed against either party to any suit or special proceedings.

ART. IV. Sections 63 and 529 of the code of Civil Procedure are hereby repealed.

ART. V. This Order shall take effect 90 days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, Sept. 26, 1911.

EXECUTIVE ORDER.

Amending Section 10 of Act No. 9, entitled "An act to provide Sanitary Rules and Regulations for the Canal Zone, Isthmus of Panama, and for the enforcement thereof," enacted September 2, 1904.

By virtue of the authority vested in me, I hereby establish the following order for the Canal Zone:

ARTICLE I. Section 10 of Act No. 9, entitled "An act to provide sanitary rules and regulations for the Canal Zone, Isthmus of Panama, and for the enforcement thereof," enacted September 2, 1904, is hereby amended so as to read as follows:

SEC. 10. Every physician, druggist, school teacher, clergyman, midwife, nurse, head of a family, or other person in attendance on or in charge of any one sick or injured, having knowledge of the existence in any district of the Canal Zone of any of the diseases hereinafter named, shall immediately report the same to the District Physician or District Sanitary Inspector. The diseases required to be so reported are:

Measles, rubella (rotheln), scarlet fever, typhus fever, relapsing fever, typhoid fever, malarial fever, yellow fever, Asiatic cholera, plague, tetanus, anthrax, small-pox, chicken-pox, (varicella), diphtheria, (croup), tuberculosis (of any organ), glanders, epidemic cerebrospinal meningitis, leprosy, infectious diseases of the eye, puerperal septicaemia, erysipelas, whooping cough, dysentery.

Any person who fails to make due report, as required by this order, of any of the above enumerated diseases shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine not exceeding \$25.00, or by imprisonment in jail not exceeding thirty days, or by both such fine and imprisonment in the discretion of the court.

ART. II. This order shall take effect sixty (60) days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, Oct. 14, 1911.

EXECUTIVE ORDER.

To Prohibit the Practise of Medicine, Surgery, Dentistry, Pharmacy, or Midwifery without a License.

By virtue of the authority vested in me, I hereby establish the following order for the Canal Zone:

SECTION 1. It shall be unlawful for any person to practise or attempt to practise medicine, surgery, dentistry, pharmacy or midwifery within the Canal Zone without first having obtained a license therefor from the Board of Health of the Canal Zone. Any person thus offending shall be punished by a fine not exceeding Twenty-five Dollars (\$25.00), or by imprisonment in jail not exceeding thirty (30) days, or by both such fine and imprisonment in the discretion of the court; provided that this order shall not apply to commissioned surgeons of the United States Army and Navy, or Marine Hospital Service, nor to physicians, surgeons, dentists or pharmacists and their assistants and nurses employed by the Isthmian Canal Commission, nor to nurses acting under the orders of a licensed physician.

SEC. 2. Any person shall be regarded as practising medicine within the meaning of this order who shall prescribe for, operate on, or in any wise attempt to heal, cure or alleviate, or who shall in any wise treat any disease or any physical or mental ailment of another; provided that nothing in this order shall be construed to prohibit gratuitous services in case of emergency, or to the administering of ordinary household remedies.

SEC. 3. This order shall take effect sixty (60) days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, Oct. 14, 1911.

EXECUTIVE ORDER.

By authority of the President of the United States, it is ordered:

That Act No. 14 enacted by the Isthmian Canal Commission, by authority of the President under date of September 3, 1904, entitled "An Act to Establish a Penal Code for the Canal Zone, Isthmus of Panama," as amended by the Executive Order issued under the authority of the President by the Secretary of War, December 1, 1909, be, and the same is hereby, amended so that Section 456 of said Penal Code as amended in said Executive Order, shall now read as follows:

"The license fees for permits issued by the Treasurer under the provisions of this Title shall be as follows: For every permit issued to carry a firearm abroad, five dollars (\$5); for every permit authorizing an overseer or watchman engaged by a private employer, ten dollars (\$10), for each watchman or overseer so authorized to carry a firearm; for each hunting permit, five dollars (\$5); provided that no charge shall be made for hunting permits issued to enlisted men of the land or naval forces of the United States stationed on the Isthmus of Panama. The treasurer shall keep a record of all licenses issued by him, with the name and residence of the persons to whom they are issued, and the date and serial number thereof."

HENRY L. STIMSON,
Secretary of War.

WAR DEPARTMENT,
Washington, D. C., November 3, 1911.

EXECUTIVE ORDER.

To prevent the unauthorized purchase of supplies and equipment from persons in the Army or Navy.

By virtue of the authority vested in me, I hereby establish the following order for the Canal Zone:

SECTION 1. Whoever shall knowingly purchase or receive in pledge for any obligation or indebtedness from any soldier, officer, sailor, or other person called into or employed in the military or naval service, any arms, equipment, ammunition, clothes, military stores, or other public property, whether furnished to the soldier, officer, sailor, or person under a clothing allowance or otherwise, such soldier, officer, sailor, or other person not having a lawful right to pledge or sell the same, shall be fined not more than five hundred dollars, and imprisoned in jail not more than two years; and the Circuit Court of the Circuit wherein such supplies or equipment may have been unlawfully purchased or received in pledge shall have jurisdiction of the offense.

SEC. 2. This order shall take effect sixty days from and after its publication in the Canal Record.¹

WM. H. TAFT.

THE WHITE HOUSE, November 15, 1911.

EXECUTIVE ORDER.

To amend Sections 1 and 2, of Act No. 2, of the Canal Zone Laws, Relating To Notaries Public, Enacted August 17, 1904, and for other purposes.

By virtue of the authority vested in me, I hereby establish the following Executive Order for the Canal Zone:

ARTICLE I. Section 1, of Act No. 2, entitled "An act authorizing the appointment of Notaries Public, defining their duties, fixing their terms of office, prescribing their fees, and for other purposes," enacted August 17, 1904, is hereby amended so as to read as follows:

SECTION 1. The Head of the Department of Civil Administration is hereby authorized to appoint and commission such number of persons to the office of Notary Public as the public good requires, to hold for three years from the date of their appointment, with jurisdiction co-extensive with the limits of the Canal Zone, or throughout the Judicial Circuit in which the person appointed Notary Public resides, in the discretion of the Head of the Department of Civil Administration and to be stated by him in the certificate of appointment.

ART. II. Section 2 of the above described Act No. 2 is hereby amended so as to read as follows:

SEC. 2. The appointment of a Notary Public shall be in writing, signed by the Head of the Department of Civil Administration, and shall be substantially in the following form:

Canal Zone, Isthmus of Panama.

This is to certify that, of the Judicial Circuit of the Canal Zone, has this day been appointed by me a Notary Public with jurisdiction co-extensive with the limits of the Canal Zone (or with jurisdiction throughout the said Judicial Circuit, as the case may be), for the term of three years from this date.

Witness my official signature at, Canal Zone, this day of, A. D., 1911.

Head of the Department of Civil Administration.

ART. III. Any and all appointments of Notaries Public heretofore made under said Act No. 2 with jurisdiction throughout the Canal Zone are hereby ratified and confirmed, and all of the acts and doings of such Notaries done in the Canal Zone outside of their respective Judicial Circuits, if otherwise legal, are hereby validated.

This order shall not be construed to require the reappointment of the existing Notaries Public, but these shall continue in office to the end of their respective terms as though this order had not been established.

ART. IV. This act shall take effect from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, November 18, 1911.

¹ Published in The Canal Record of November 29, 1911.

EXECUTIVE ORDER.

To Amend Executive Order Prohibiting the Practice of Medicine, Surgery, Dentistry, Pharmacy, or Midwifery within the Canal Zone without a License.

By virtue of the authority vested in me I hereby establish the following order for the Canal Zone, amending the Executive Order promulgated on October 14, 1911, to read as follows:

SECTION 1. It shall be unlawful for any person to practice or attempt to practice medicine, surgery, dentistry, pharmacy or midwifery within the Canal Zone without first having obtained a license therefor from the Board of Health of the Canal Zone. Any person thus offending shall be punished by a fine not exceeding twenty-five dollars (\$25.00), or by imprisonment in jail not exceeding thirty (30) days, or by both such fine and imprisonment in the discretion of the court; *provided* that this order shall not apply to the commissioned surgeons of the United States Army and Navy, or Marine Hospital Service, nor to physicians, surgeons, dentists or pharmacists and their assistants and nurses employed by the Isthmian Canal Commission, nor to nurses acting under the orders of a licensed physician.

SEC. 2. Whoever, not having registered as aforesaid, shall advertise or hold himself out to the public as a physician or surgeon, by appending to his name the letters "M. D.," or using the title of doctor, meaning thereby a doctor of medicine, or shall pretend to a knowledge of medicine or surgery, shall be punished by a fine not exceeding twenty-five dollars (\$25.00), or by imprisonment not exceeding thirty (30) days, or by both in the discretion of the court.

SEC. 3. Any person shall be regarded as practicing medicine within the meaning of this Order who shall prescribe for, operate on, or in anywise attempt to heal, cure or alleviate, or who shall in anywise treat any disease or any physical or mental ailment of another; *provided* that nothing in this Order shall be construed to prohibit (a) the practice of the religious tenets of any church in the ministration of the sick or suffering by mental or spiritual means without the use of any drug or material remedy, whether gratuitously or for compensation, provided that such sanitary laws, orders, rules and regulations as now are, or hereafter may be, in force in said Canal Zone are complied with; or, (b) gratuitous services in case of emergency; or, (c) the administering of ordinary household remedies.

SEC. 4. This Order shall take effect on January 1, 1912.

WM. H. TAFT.

THE WHITE HOUSE, December 26, 1911.

EXECUTIVE ORDER.

By authority vested in me by law, I establish the following order for the Canal Zone:

SECTION 1. A census of the Canal Zone, Isthmus of Panama, shall be taken by the Department of Civil Administration of the Isthmian Canal Commission not later than April 30, 1912, under such rules and regulations in conformity with this order as may be prescribed by the Head of Department of Civil Administration with the approval of the Chairman of the Isthmian Canal Commission.

SEC. 2. The census shall embrace inquiries relating to population, and shall include for each inhabitant the name, location, sex, color, age, conjugal condition, place of birth, citizenship, length of residence in Canal Zone, occupation, whether or not an employe, and if an employe of the Isthmian Canal Commission, the Panama Railroad Company, the United States Government, or of any arm or branch thereof, this fact to be shown, together with metal check number if an employe of the Isthmian Canal Commission or the Panama Railroad Company, school attendance, literacy, the language spoken, whether blind, deaf and dumb, insane, or imbecile, and any other information which, under the rules and regulations referred to in Section 1, may be required.

SEC. 3. It shall be the duty of each enumerator to visit personally each dwelling house in his subdivision, and each family therein, and each individual living out of a family in any place of abode, and by inquiry made of the head of each family, or of the member thereof deemed most competent and trustworthy, or of such individual living out of a family, to obtain each and every item of information and all particulars required by this Order; and in case no person shall be found at the usual place of abode of such family, or individual, living out of a family, competent to answer the inquiries made in compliance with the requirements of this Order, then it shall be

lawful for the enumerator to obtain the required information as nearly as may be practicable from families or persons living in the neighborhood of such place of abode. It shall be the duty also of each enumerator to forward the original schedules, properly filled out and duly certified, to the supervisor or other chief census officer of his district as his returns under the provisions of this Order; and in the event of discrepancies or deficiencies being discovered in these schedules he shall use all diligence in correcting or supplying the same.

SEC. 4. The compensation of enumerators and other persons engaged in taking the census shall be fixed by the Head of Department of Civil Administration, subject to the approval of the Chairman of the Isthmian Canal Commission.

SEC. 5. Every supervisor, supervisor's clerk, enumerator, interpreter, special agent, or other employe shall take and subscribe to an oath or affirmation to faithfully execute the duties imposed by his employment.

SEC. 6. Any supervisor, supervisor's clerk, enumerator, interpreter, special agent, or other employe, who, having taken and subscribed to the oath of office required by this Order, shall, without justifiable cause, neglect or refuse to perform the duties enjoined on him by this Order, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding five hundred dollars; or if he shall, without the authority of the officer in charge of the census, publish or communicate any information coming into his possession by reason of his employment under the provisions of this Order, he shall be guilty of a misdemeanor and shall upon conviction thereof be fined not to exceed one thousand dollars, or be imprisoned not to exceed two years, or both so fined and imprisoned, in the discretion of the court; or if he shall wilfully and knowingly swear to or affirm falsely, he shall be deemed guilty of perjury, and upon conviction thereof shall be imprisoned not exceeding five years and be fined not exceeding two thousand dollars; or if he shall wilfully and knowingly make a false certificate or a fictitious return, he shall be guilty of a misdemeanor, and upon conviction of either of the last named offenses he shall be fined not exceeding two thousand dollars and be imprisoned not exceeding five years; or if any person who is or has been an enumerator shall knowingly or wilfully furnish, or cause to be furnished, directly or indirectly, to the officer in charge of the census, or to any supervisor of the census, any false statement or false information with reference to any inquiry for which he was authorized and required to collect information, he shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding two thousand dollars and be imprisoned not exceeding five years.

SEC. 7. It shall be the duty of all persons over twenty-one years of age when requested by the officer in charge of the census, or by any supervisor, or enumerator acting under the instructions of the said officer in charge of the census, to answer correctly, to the best of their knowledge, all questions on the census schedules applying to themselves and to the family to which they belong or are related, and any person over twenty-one years of age who, under the conditions hereinbefore stated, shall refuse or wilfully neglect to answer any of these questions, or shall wilfully give answers that are false, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding one hundred dollars.

And it shall be the duty of every owner, proprietor, manager, superintendent, or agent of a hotel, apartment house, boarding or lodging house, tenement, or other building, when requested by the officer in charge of the census, or by any supervisor, or enumerator, acting under the instructions of the said officer in charge of the census, to furnish the names of the occupants of said hotel, apartment house, boarding or lodging house, tenement, or other building, and to give thereto free ingress and egress to any duly accredited supervisor or enumerator, so as to permit of the collection of statistics for census purposes including the proper and correct enumeration of all persons having their usual place of abode in said hotel, apartment house, boarding or lodging house, tenement, or other building; and any owner, proprietor, manager, superintendent, or agent of a hotel, apartment house, boarding or lodging house, tenement, or other building who shall refuse or wilfully neglect to give such information or assistance under the conditions hereinbefore stated shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding five hundred dollars.

SEC. 8. The circuit courts of the respective circuits shall have jurisdiction of the offenses herein enumerated.

SEC. 9. This Order shall take effect on this date.

WM. H. TAFT.

THE WHITE HOUSE, *January 12, 1912.*

EXECUTIVE ORDER.

To Provide an Inexpensive Method for the Administration of Estates of Deceased and Insane Persons in Certain Cases, and to Repeal Act 24, of the Canal Zone Laws, and the Executive Orders Amendatory Thereto.

By virtue of the authority invested in me, I hereby establish the following Executive Order for the Canal Zone:

SECTION 1. Whenever an employe in the service of the Isthmian Canal Commission, or the Government of the Canal Zone, or of the Panama Railroad Company, shall die, leaving an estate in the said Zone, or whenever such decedent, being a citizen of the United States, leaves an estate in the Canal Zone or in the Republic of Panama; and the said estate consists of personal property only, not exceeding in value the sum of \$1,000.00, and a regular administration shall not have been instituted in the courts of the Canal Zone, the Collector of Revenues for the Canal Zone is hereby authorized and directed to take possession of the estate of the said deceased person and to make a complete inventory thereof and present the same to the Judge of the Circuit Court of the First Judicial Circuit of the Canal Zone, to be filed by the said judge in the records of his court when approved by him.

SEC. 2. The Collector of Revenues, with the approval of the Judge of the Circuit Court of the First Judicial Circuit, out of the assets of the estate, may pay the burial expenses of the said deceased person and all expenses necessarily incurred in securing possession of the estate and of administering the same until it is turned over to the heirs or other parties entitled thereto, and he may also pay the expenses of the transportation of the remains of the decedent to the United States, if he is an American Citizen and such transportation is desired by the surviving relatives. He shall also pay the lawful debts of the deceased, with the approval of the Circuit Judge.

SEC. 3. In case the deceased shall have to his credit with the Isthmian Canal Commission, the Government of the Canal Zone, or the Panama Railroad Company, any sum as salary or other acknowledged claim, the amount so due shall be paid to the Collector of Revenues and be by him administered as a part of said estate in the manner prescribed by this Order; *Provided*, that if there should be a regular administration upon the estate of the deceased in a court of competent jurisdiction of the Canal Zone, then the sum due to the deceased shall be paid to the regular executor or administrator of the estate appointed by said court.

SEC. 4. After all of the expenses connected with the burial of the deceased person and in securing possession of the estate and in otherwise administering the same, together with the lawful debts of the deceased, have been fully paid, the balance of such estate shall be paid by the Collector of Revenues to the parties entitled to receive such estate; but before making such payment, the approval of the Judge of the Circuit Court must be obtained.

SEC. 5. If the deceased employee is an alien and has no heirs in the Canal Zone, the Collector of Revenues is hereby authorized and directed to deliver the residue of the decedent's estate to the diplomatic or consular representative of the country of which the decedent was a citizen or subject accredited to the Republic of Panama, to be delivered by such representative to the heirs of the decedent; if the deceased is a citizen of Panama, the residue of the estate may be delivered to his heirs in Panama, or to the authorities designated for that purpose by the Panamanian laws or decrees.

SEC. 6. After the estate has been fully administered by the Collector of Revenues and the residue thereof has been turned over to the parties entitled to the same according to this Order, the Collector of Revenues shall file a final report of his acts and doings in the estate with the Judge of the Circuit Court, and accompany said report with the proper vouchers and other supporting papers, showing the receipts and disbursements made by him in administering the estate, and the Circuit Judge shall examine said report, and if he finds it correct, he shall approve the same and discharge the Collector of Revenues as such administrator.

SEC. 7. If the decedent should leave a widow, or minor children, or dependent relative in necessitous circumstances to be determined by the Circuit Judge, the residue of the estate of the decedent, after all of the funeral expenses, the expenses of transportation of the remains of the deceased to the United States, if the remains are transported, and the other expenses incident to the administration of the estate are fully paid, shall be delivered to said widow, or minor children, or dependent relative, as the case may be, for their maintenance and support; and, except as in this section otherwise provided, the claims of the widow, minor children, or dependent relative of the deceased for this allowance shall be superior to the claims of the creditors of the deceased, *Provided*, that such preference in favor of the widow, minor children, or dependent relative shall not exceed \$500.00.

SEC. 8. If an employee of the Isthmian Canal Commission, the Government of the Canal Zone, or the Panama Railroad Company should be adjudged insane by the Canal Zone Courts and have an estate not exceeding \$1,000.00 in value and consisting entirely of personal property, and no regular guardianship of such estate shall have been instituted in the Canal Zone Courts, it shall be the duty of the Collector of Revenues to take possession of the estate of such insane person, including any salary or other acknowledged claim due to such employee by the Isthmian Canal Commission, the Canal Zone Government, or the Panama Railroad Company, and make a complete inventory thereof and file the same with the Judge of the Circuit Court of the First Judicial Circuit of the Canal Zone; and under the direction and with the approval of the Judge of the said Court, the Collector of Revenues may pay the lawful indebtedness due by the insane person, as well as the expenses incurred in administering said estate, and he shall hold the residue of the estate subject to the orders of the Circuit Judge.

If the insane person has a wife, minor child or children, or dependent relative, in necessitous circumstances, to be determined by the Circuit Judge, the court shall set aside a sufficient sum out of the said estate for their maintenance and support, not to exceed the sum of \$500.00 in the aggregate, to be paid in such manner and at such times as the Circuit Judge may prescribe, and which allowance shall be superior to all other claims against the estate; and the order of the Judge shall be sufficient authority for the Collector of Revenues to make such payment, taking proper receipts therefor.

In case the insane person is a citizen of the United States and has no wife, child or children, or dependent relative, the Collector of Revenues shall retain possession of the residue of said estate, after the debts and other charges have been paid as above mentioned, and hold same subject to the orders of the court.

If the insane person is a Panamanian and has no wife, child or children, or dependent relative, the residue of the estate, with the approval of the Circuit Judge, may be delivered by the Collector of Revenues to the authorities designated for that purpose by the Panamanian laws or decrees.

If the insane person is an alien, other than a Panamanian, and has no wife, child or children, or dependent relative, the Collector of Revenues, with the approval of the Judge of the Circuit Court, shall pay over the residue of the said estate to the diplomatic or consular representative of the country to which the insane person belongs accredited to the Republic of Panama, to be disposed of by him in accordance with the laws of his country.

SEC. 9. When the estate of the insane person is finally administered and the moneys paid over to the person or persons entitled to receive same as herein provided for, the Collector of Revenues shall make his final report on said estate to the Judge of the Circuit Court, and the Court shall approve the same, if found to be correct, and discharge the Collector of Revenues from such guardianship.

SEC. 10. When the Collector of Revenues shall have performed his duties in accordance with the provisions of this Order and shall have delivered the estate or paid over the sums due from the funds of said estate to the person or persons entitled thereto in accordance with the orders of the court, such settlement of the estate shall be deemed a lawful settlement thereof, and the Collector of Revenues shall not be accountable on his bond and shall not be liable to any other person for the estate so administered by him; *Provided*, that nothing in this Order shall prohibit the lawful heirs or claimants of any person whose estate has been settled in accordance with the provisions of this Order from bringing suit in any court having jurisdiction of the subject-matter and of the parties to the action against the person or persons who received the estate by virtue of the provisions of this act, and from recovering the same or the value thereof from such person or persons upon proof that the estate has been delivered to the persons not entitled to receive and retain same.

SEC. 11. This Order shall apply to the estate of persons who died or became insane prior to the passage of this Order, as well as to those who die or become insane after the date of its promulgation.

SEC. 12. If the Collector of Revenues shall deem it to the best interest of the estate of the deceased or insane person to convert any part or all of the property of the estate into cash, he may dispose of the same by public or private sale, with the approval of the Circuit Judge.

SEC. 13. The proceedings to be had before the Judge of the Circuit Court as herein provided for may be conducted without the necessity of any prior notice being given of the same, either by publication or otherwise; and the judge may proceed in such cases in open court or in chambers, and shall give precedence to such matters over all other business pending before him, in order that the estates may be administered and closed as expeditiously as the rights of all parties concerned may permit. No court costs of any kind shall be taxed against estates administered under the provisions of this Order.

SEC. 14. The official bond of the Collector of Revenues shall be security for the moneys and properties received by him in the performance of the duties prescribed for him by this Order.

SEC. 15. Act 24, of the Canal Zone Laws, entitled "An Act providing for an inexpensive method of Administration upon the Estates of Employees of the Government of the Canal Zone, or of the Isthmian Canal Commission, who are citizens of the United States and who die in the Canal Zone, Isthmus of Panama, leaving estates of small value upon which regular administration is deemed inadvisable," enacted March 1, 1905, and Executive Order dated June 22, 1907, effective July 1, 1907, and Executive Order dated July 21, 1909, respectively, amendatory of said Act 24, and all laws in conflict herewith, are hereby repealed.

SEC. 16. This Order shall take effect 30 days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, February 5, 1912.

EXECUTIVE ORDER.

To Provide a Maximum Speed for Motor Vehicles in the Canal Zone and Establish a Rule of the Road.

By virtue of the authority vested in me, I hereby establish the following order for the Canal Zone.

SECTION 1. No automobile, motor cycle, or bicycle shall be driven or operated over the roads or streets of the Canal Zone at a speed exceeding fifteen (15) miles an hour on straight roads, or at a speed exceeding eight (8) miles an hour when approaching or traversing curves, forks, or cross-roads, or when traveling over the streets of any city, town, or village of the Canal Zone. The owner of an automobile, if within the car, shall be held responsible for its speed; in the absence of the owner, the person actually driving the automobile shall be held responsible. The person operating a motor cycle or bicycle shall be held responsible for its speed.

SEC. 2. In the operation or employment of automobiles, motor cycles, bicycles, carriages, wagons, and other vehicles over Canal Zone roads or streets, the following rules shall be observed, viz: All such vehicles, in meeting and passing other vehicles, or in being overtaken and passed by other vehicles, shall keep to the left of the road; and in overtaking and passing other vehicles they shall keep to the right. The owner of an automobile or other vehicle, if riding therein, shall be held responsible for the driving or operation thereof, agreeably to the provisions of this section; in the absence of the owner, the person driving or operating such vehicle shall be held responsible. In the case of any motor cycle or bicycle, the person operating same shall be held responsible.

SEC. 3. Any person violating any provision of this order shall be punished by a fine not exceeding One Hundred Dollars (\$100.00), United States currency, or by imprisonment not exceeding thirty (30) days, or by both such fine and imprisonment, in the discretion of the court.

SEC. 4. The Executive Order of February 27, 1908, relative to the speed of automobiles on Canal Zone roads is hereby repealed.

SEC. 5. This order shall take effect thirty days from this date.

WM. H. TAFT.

THE WHITE HOUSE, February 28, 1912.

EXECUTIVE ORDER.

To Prevent Trespassing Upon Reservations.

By virtue of the authority vested in me, I hereby establish the following Order for the Canal Zone:

SECTION 1. Every person who shall go into or upon any reservation or other place belonging to or under the control of the United States of America, the Canal Zone Government, or the Panama Railroad Company, after such reservation or place has been posted as hereinafter prescribed in this Order, and without the permission of the person in charge of such reservation or place, shall be deemed guilty of trespassing; and upon conviction shall be punished by a fine not to exceed \$25.00, or by imprisonment in jail not to exceed 30 days, or by both such fine and imprisonment in the discretion of the court.

SEC. 2. The posting required by this Order shall consist of printed or painted signs, conspicuously placed, by the authority of the Chairman of the Commission, at or near the reservation or place from which the public are to be excluded, and shall in plain and simple words warn all persons against trespassing upon the reservation or place.

SEC. 3. Every person who wilfully injures, destroys, or removes any sign placed or erected under the provisions of this Order shall be punished by a fine not to exceed \$100.00, or by imprisonment in jail not to exceed 3 months, or by both such fine and imprisonment in the discretion of the court.

SEC. 4. This Order shall take effect 60 days from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, *April 17, 1912.*

EXECUTIVE ORDER.

To Amend the Executive Order Providing for the Collection of a Distillation Tax.

By virtue of the authority vested in me, the Executive Order of May 13, 1911, providing for the collection of a distillation tax in the Canal Zone, is amended as follows:

SECTION 1. The output of each still may be measured by any method approved by the Chairman of the Isthmian Canal Commission, if in his opinion measurement by meter, as provided in Section 3 of said Executive Order, is not satisfactory.

SEC. 2. On and after January 1, 1913, the right to operate any still within the Canal Zone shall cease and determine, and any person who shall, on or after that date, manufacture or distill any of the spirits or alcoholic liquors enumerated in the Executive Order of May 13, 1911, shall be guilty of a misdemeanor and, upon conviction, shall be punished by a fine not exceeding One Thousand Dollars (\$1,000.00) or by imprisonment in the District Jail for a term not exceeding twelve (12) months, or by both such fine and imprisonment, within the discretion of the court.

SEC. 3. This order shall take effect from and after this date.

WM. H. TAFT.

THE WHITE HOUSE, *May 21, 1912.*

APPENDIX U.

CHARTS SHOWING ORGANIZATION OF ISTHMIAN CANAL COMMISSION AND PANAMA RAILROAD CO., JULY, 1912.

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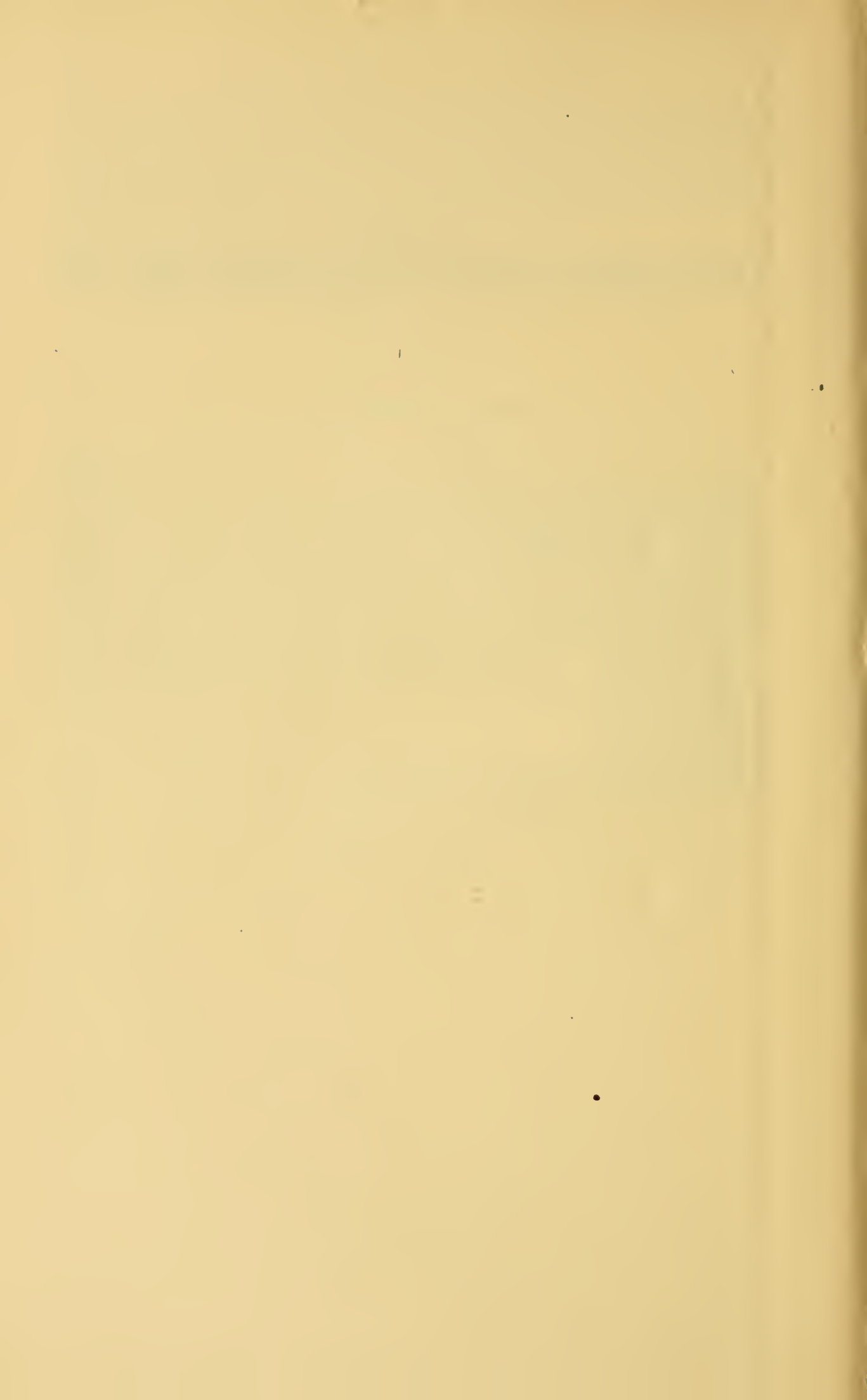
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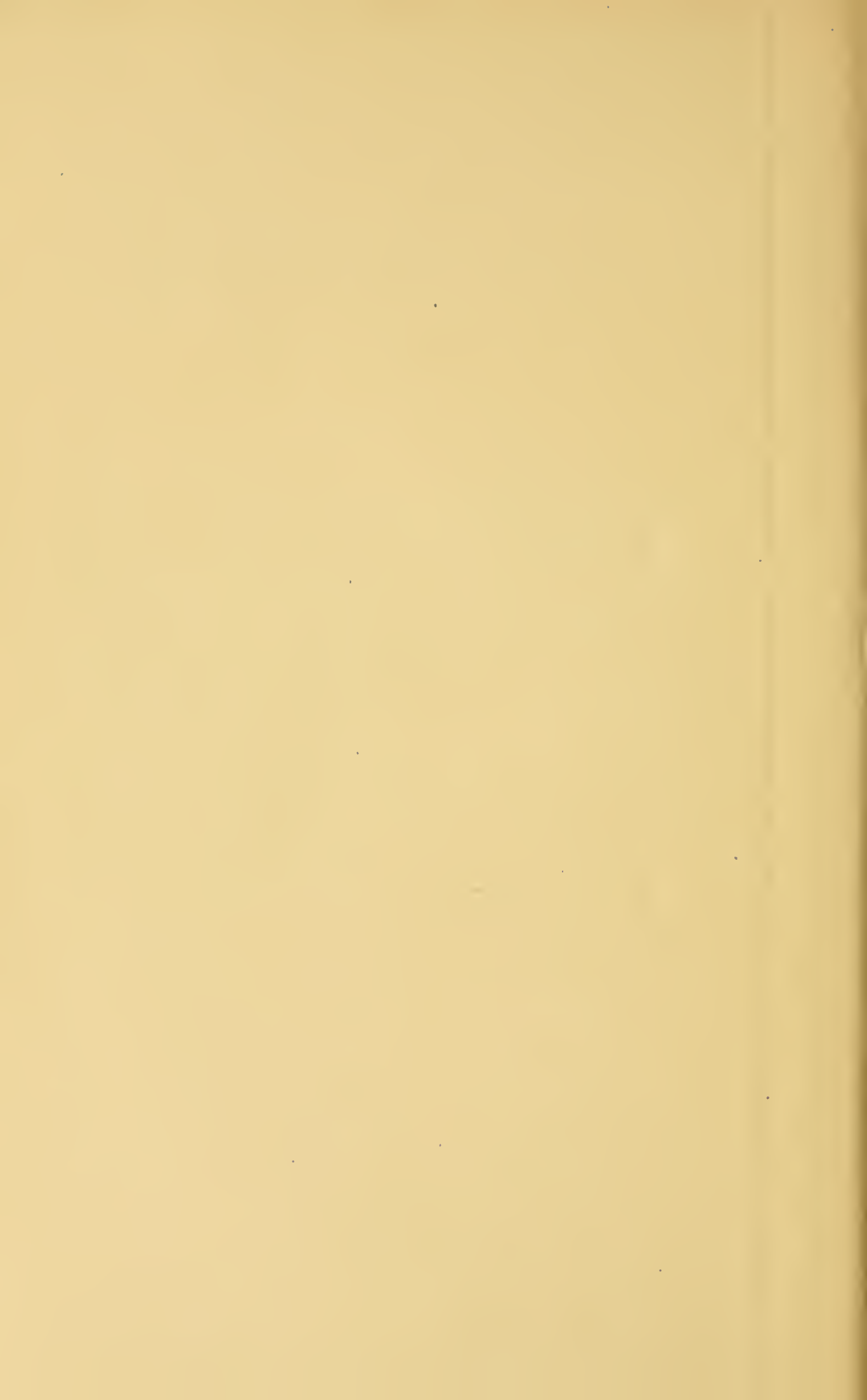
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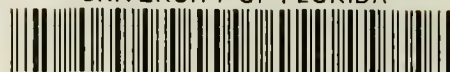
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